# ENGINEERING AND MINING JOURNAL

May, 1946

Pouring a ladle of lead bullion into a refining kettle for desilverizing

## The Shaped Charge—Something New in Blasting

Page 58

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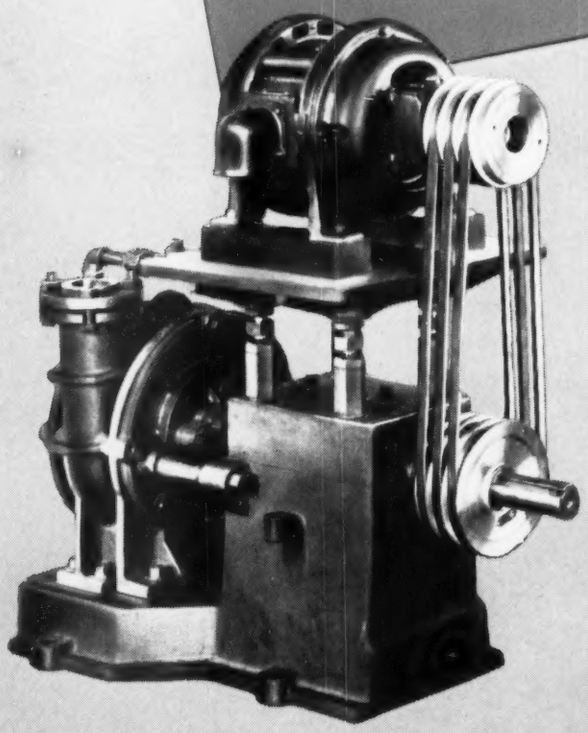

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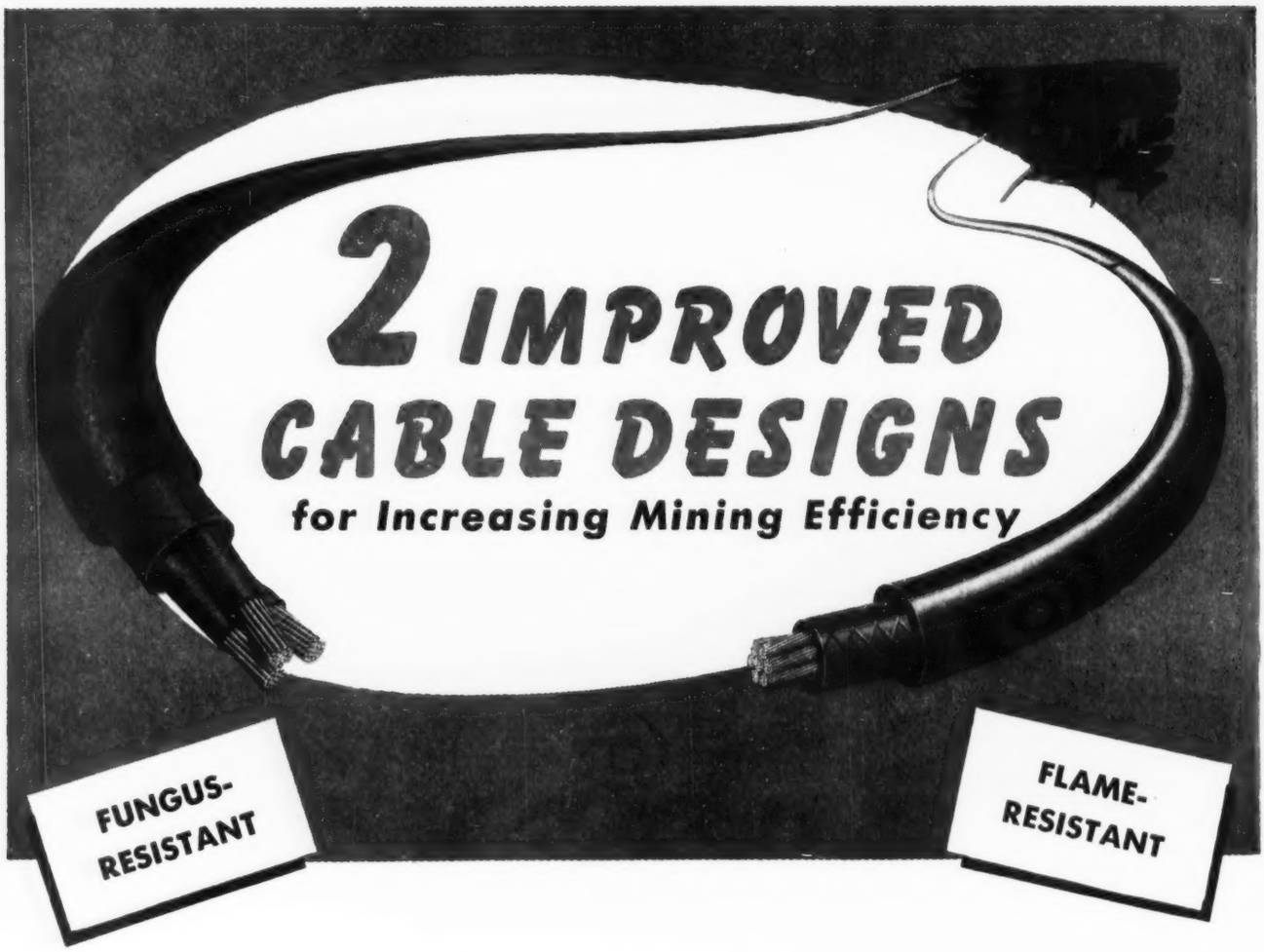


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# ENGINEERING AND MINING JOURNAL

MAY, 1946

## Over-Zealous Bureaucracy Takes a Whipping

WE HOPE that the drubbing the House gave the Office of Price Administration, in renewing the life of the agency for a limited period, means something deeper than mere public discontent over the annoyances of certain minor consumer-goods shortages.

Experience has taught us that Congress does not act drastically except under pressure, either from the public at large or from powerful lobbies. In this case, it seems as though the letters of thousands of unorganized individuals constituted an importance factor. We hope these discontented citizens are more disturbed by the trend toward controls becoming part of our national life than by minor annoyances.

It might be hard to point out a single high Government official who espouses permanent controls. Nevertheless, the diverse actions of Government add up to a trend in this direction. In our industry, Government lends itself to inflationary wage settlements and holds the bait out to producers that it will take care of their added costs through subsidies. The public might realize its position on this spiraling merry-go-round if it saw the results wholly reflected in prices, and complain. However, the cost of subsidies being an expense which the average citizen does not translate into the actual "take" from his own purse, the public tends to remain apathetic. Meanwhile, the squeeze play jockeys the mining industry's economy farther and farther into a dependent and an artificial position, which, as time goes on, gradually makes Government handouts and regulations harder to abandon.

As one of its gestures of appeasement, and to avoid the McFarland amendment (*E.&M.J.*, March, pp. 103 and 117) being written into law, OPA will probably grant most of the increases on copper, lead, and zinc contemplated in the amendment. The previous insistence on holding these price ceilings down, despite a worldwide upward trend and the certainty that Government-supported cost increases will demand higher prices whenever price controls are removed, is a typical example of the over-zealousness through which OPA brought about its own humiliation. In many cases an almost fanatical attitude against price increases discouraged production and forward planning, thus heading off the most potent basic cure for inflation. This experience confirms all previous lessons showing that Government simply cannot handle the delicate balances, intricacies, and swift changes of business realistically.

If prices are to be altered more in keeping with present and future conditions, and if the web of Government controls is somewhat relaxed, the mining industry will be in better condition to produce and plan with confidence. Had it not been for the McFarland amendment and the Executive action it may "inspire," virtually all producers of copper, lead, and zinc would soon be on the "spiral merry-go-round," whirling giddily to destinations unknown.

## Potash Industry in Excellent Condition

TWO IMPORTANT REPORTS on the domestic potash industry, covering its reserves of potash and its economics respectively, have recently appeared. The tonnage estimate in the former, made by Samuel H. Dolbear, exceeds any figures previously prepared by the Government and leads Mr. Dolbear to the conclusion that any apprehension as to the adequacy of the nation's resources of this vital fertilizer ingredient is unwarranted. He finds that the known developed reserves are good for 290 years at the 1935-'39 annual consumption and import rates. Moreover, for a long time thereafter our food supply will still be protected so far as potash is concerned, if only because of the additional huge undeveloped reserve in southeastern Utah, which appears to be potentially as important as the present producing Carlsbad area in New Mexico. For industry as well as agriculture there is no foreseeable shortage of potash for hundreds of years. All this is true without taking into account so-called strategic reserves, the exploitation of which does not necessarily involve the element of profit.

The study of the potash industry's economics, made by Jules Backman, of New York University's School of Commerce, Accounts and Finance, is very

flattering to the producers and their conduct of their affairs. They have been able, states the report, to meet their customers' demands by expanding their output rapidly "while the long-term trend of prices has been downward and wartime prices were held stable." Moreover, their record on wages and labor relations "has few parallels in this country," praise which is supported by the figures cited. Only three industries out of 175 reported by the U. S. Bureau of Labor Statistics had higher average hourly earnings than the potash workers last July. These earnings exceeded the average for all manufacturing workers by 32.4 cents.

In the light of these findings no excuse exists for intervention by the Government in the potash industry's affairs. Whatever the improvement that may be achieved in their conduct, it is likely to be accomplished more surely under the operators' skilled management than under a measure of Federal supervision exceeding that already existing.

## A Possible Threat to Blast-Hole Diamond Drilling

MINING COMPANIES that have adopted blast-hole diamond drilling are now threatened with a possible increase in breaking cost arising from a projected increase in the price of industrial diamonds, the circumstances of which are told in the news on p. 92. Anything that tends to retard the further development and application of this useful technique is unfortunate but not necessarily fatal. Rising costs are among the problems of the times. Blast-hole diamond drilling has in its favor, aside from any question of cost, the high production per man-shift that it makes possible, its smaller demand on skilled labor, and the fact that it readily permits ground to be drilled months in advance of stoping.

The effect of a higher breaking cost, if it materializes because of higher diamond prices, will have to be appraised for each individual operation. Mining conditions, and consequently mining costs, vary not only from mine to mine but from stope to stope. Where the operation using diamond drills for stoping purposes has been in the black by only a narrow margin, it may conceivably be discontinued, or revert to the use of rock drills, if the proposed increase becomes an actuality. Breaking cost alone, however, will not determine the matter in the majority of cases. Engineers, moreover, will as usual study to employ their ingenuity.

Operators using industrial diamonds, however, are not likely to be complacent respecting the possibility of higher prices. Reactions already noted in various quarters range from dissatisfaction to discouragement. If those who control the supply and price set too high a price, they will surely injure for themselves the present growing market afforded by the mining industry.

## Higher Gold Price Not Imminent

BECAUSE of the experience of the thirties, when President Roosevelt devaluated the dollar, many producers of gold are now looking hopefully for another similar step. They base their hopes on the widely held belief that the cost of the recent war cannot, or will not, be borne "straight up" and that devaluation will be the expedient whereby the creditors of governments the world over will be made to "hold the sack." From such a move, many producers hope to benefit as they did after 1934.

The devaluation of 1934 was not done to aid the gold producer, who was simply an incidental beneficiary. It was done for two other purposes: to encourage exports and to stimulate the lagging domestic economy by price inflation. A cheaper dollar made our goods cost less to the foreigner in terms of foreign currency, thus re-equilibrating the dollar to sterling and other currencies which had devaluated. Domestically, the anticipated rise in prices was expected to give business a "shot in the arm" and help to overcome the depression psychology by giving some appearance of prosperity.

The gold miner benefited because the scheme failed on the domestic front. The people are not monetary economists. To them a dollar remained a dollar, despite the lesser gold content. They were so accustomed to doing without gold that the realization that eagles would contain less gold was meaningless. Besides, at the same time, gold was made contraband, so it was impossible to obtain eagles anyway. Thus, domestic prices did not respond to devaluation. The gold miner's product brought more dollars and his costs remained low.

Domestic price inflation would probably have occurred had there been any fixed relationship between our gold stock and the volume of currency and credit. The effect might have been slow, foreign trade being such a small part of our total trade, but had we been on a gold standard the inflowing gold from expanded exports and rejuvenated gold mining would have forced a commensurate expansion of our currency and credit and thus would have tended to raise prices. However, by practices that began with the initiation of the Federal Reserve system in the early twenties, the volume of currency and credit was manipulated more or less independently of the gold stock. Also, the practice of sterilization was instituted. Thus,

the gold stock was divorced from our domestic economy and retains only a remote and more or less theoretical connection with it. The Federal Reserve system is still required to maintain a minimum ratio of gold to currency and credit, but we can be sure that if the gold stock should decline and it should seem undesirable to contract the volume of currency and credit, the legal ratio would be altered, as was recently done, or some equivalent hocus-pocus devised.

With gold divorced from the domestic financial structure as it is today, there is no point in devaluating the currency in terms of gold in order to inflate prices or to shift the weight of the debt back on the creditors. These objectives can be accomplished by currency and credit manipulation. In fact, with a managed currency, devaluation in terms of gold serves only one domestic purpose—to encourage gold mining. This function seems to have no appeal to our monetary economists at present. They may feel differently if we continue to fall for the "painless" solutions that become available when a currency is cut loose from its moorings. As China discovered during the war, redemption in gold may become very desirable when a government's credit gets in jeopardy and devaluation becomes unavoidable.

On the other hand, devaluation still fulfills an international purpose, which has already been utilized by several of the financially weak nations since the war. By devaluation, nations can lower wages and costs in terms of foreign currencies without facing the political and psychological consequences of lowering domestic prices and wages.

The International Fund and Bank were devised in part to avoid currency devaluations. To the nations that will make the necessary effort and sacrifice to keep their economies in balance, these new organizations will offer few advantages over the gold standard. To those that seek compromises and painless solutions, the fund and bank offer a new source of credit. However, unless the creditor nations are gullible beyond belief, the new system is not an inexhaustible wellspring. If it continues to function, the nations that persist in living beyond their means will find it just as disciplinary as the gold standard. After they use up their credit, they will probably resort to devaluation again, and the new generation of economists will realize that nations are simply not sufficiently ethical to adhere to standards created without work.

In brief, it seems as though the gold miner will have to wait for a higher gold price until (1) continued unbalanced budgets so undermine the Government's credit that redemption in gold, accompanied by devaluation, will be a desirable safety valve, or (2) the exhaustion of credit by nations which cannot discipline themselves financially leads to a new cycle of competitive devaluation. Also, a depression may bring costs down. Until some such event gold miners will probably have to meet the inevitable rise in costs by a painstaking search for more efficient operating methods. This subject will be discussed in our next issue.

# MILLING AROUND

The stockpile bill (S-752) has been modified by the House Committee on Military Affairs so that civilian participation is purely advisory. Considering how the military brethren resisted stockpiling proposals prior to the war, and remembering Pearl Harbor, this modification seems like a backward step.

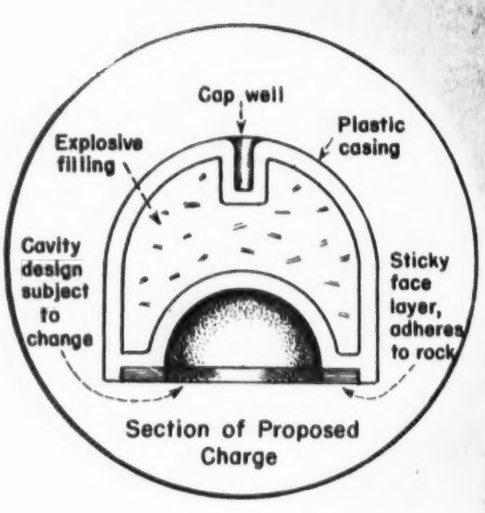
*At the meeting of the Canadian Institute of Mining and Metallurgy we were impressed by the progressive attitude of the group, also the comparative youthfulness of Canadian mine managers and responsible technical men. Possibly these two features are not unrelated.*

According to Cerro de Pasco's annual report, on December 4 the Government of Peru decreed that all employers should pay 15 days' wages to laborers and a month's salary to others as a "World Peace Bonus." This little idea cost the company about $225,000, thus proving the theory that there is a price to peace.

*The Australian Institute of Mining and Metallurgy has done a laudable job in preparing a 27-page pamphlet on "Mining and Metallurgy as a Career." Written for the young man who is interested in knowing more about mining with a view to becoming part of the industry, the pamphlet describes the scope and processes of mining, the location and character of the principal mines and smelters, wages, salaries, and employment opportunities. It also lists the schools which offer training in mining and metallurgy, synopsizing the curricula and listing degrees offered by the various institutions.*

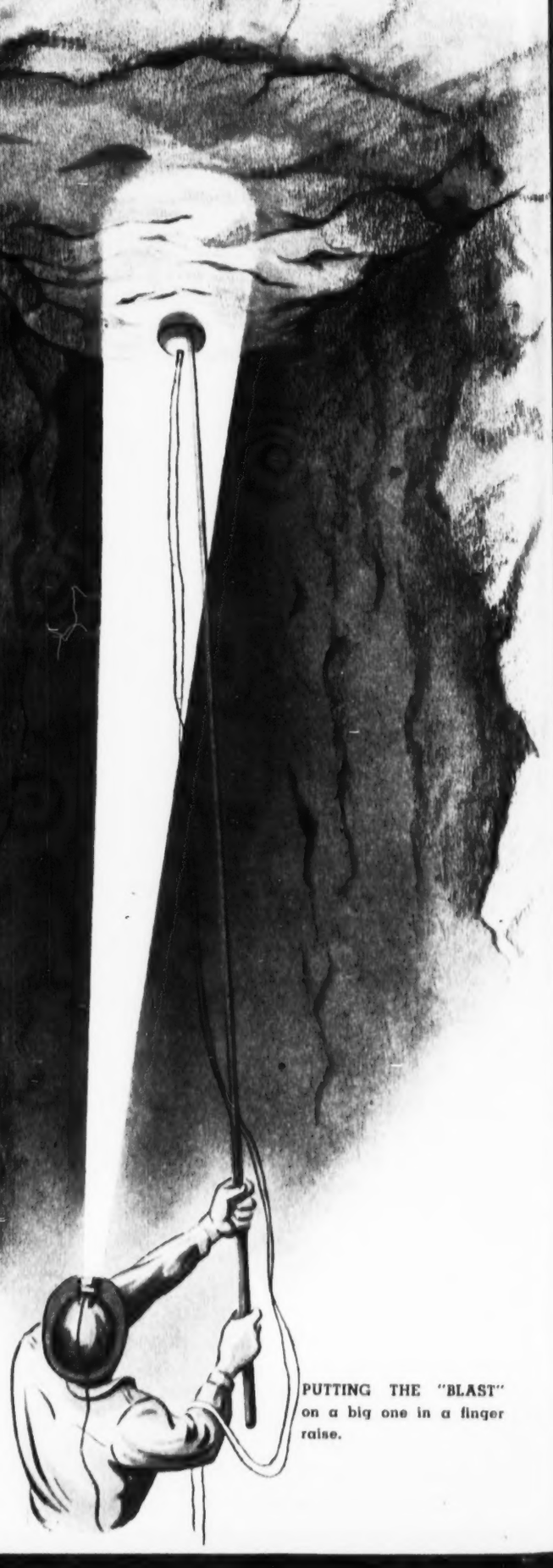
Despite the views of the economic theorists who would like to throw off the restraints which gold imposes on currency jugglers, the yellow metal still has a strong claim on the imaginations and desires of the world's people. Witness the excitement over Orange Free State gold shares, touched off by one seven-inch high-grade sample in a single drill hole.

# THE SHAPED CHARGE.




**JOHN B. HUTTL.**
Associate Editor

INTERESTING AND SIGNIFICANT test work involving the use of shaped powder charges in underground blasting operations is in progress at the property of National Tunnel & Mines Co., at Tooele, Utah. The idea to employ this type of charge underground was originally conceived by W. T. Warren, general superintendent, after reading an article in the *Explosives Engineer*, July-August 1945 issue, by Volta Torrey, entitled "The Shaped Charge," in which the author describes in detail the application of shaped charges to demolition work in World War II, and the work done by Prof. Charles E. Munroe, of Columbian University (now George Washington University), who discovered the principle on which the shaped charge is based. The diverse weapons designed by the Army Ordnance during the recent war to destroy concrete fortifications, pillboxes, tanks, and other war machines nearly all are based on Professor Munroe's discovery, known today as the "Munroe effect." Explained in more detail, the term means concentration of a part of the force of an explosion on a particular spot, this being accomplished by



PUTTING THE "BLAST" on a big one in a finger raise.

# for Cheaper Mine Blasting

**Applied effectively during the war to military demolition work and to destroying tanks and other war machines, this type of charge is now giving good results underground in experimental tests made by a Western mining company**

leaving a cavity in the explosive at the very spot where the maximum force is desired.

Professor Munroe discovered this phenomenon while working at the Naval Torpedo Station at Newport, R. I., some 60 or more years ago. He noticed that a molded charge of guncotton with stamped-in letters or figures when placed on an iron plate and detonated reproduced on the plate sunken images of these stampings. In one experiment Professor Munroe found that he could blow a hole in the side of a heavy steel safe by placing sticks of dynamite around a tin can, the cavity in the center of the charge created thereby bringing about the effect mentioned previously. Powder consumption, he found, was much less than with a conventional charge placed flat against the wall of the safe. Subsequent work disclosed the fact that the "Munroe effect" could be obtained with any kind of high explosive by cutting a cavity of almost any size or shape in the side of the charge placed toward the object to be cut or punctured. During the war, the Ordnance Department developed and provided the Army with a wide variety of shaped charges for demolition of enemy objectives.

Basing conclusions on the successful applications of shaped charges to demolition work during World War II as outlined in the article mentioned, W. T. Warren decided that such charges should prove useful in solving various underground blasting problems. Difficulties immediately presenting themselves were:

1. The high-speed explosives used in military shaped charges produce toxic explosion products, and as a consequence cannot be used underground.

2. Only comparatively low-speed explosives (45 to 60 percent strength dynamites) were available for use underground, and it was not known whether the rates of detonation of these explosives would be sufficient to produce the "Munroe effect."

3. Data available upon which to base design of the charge were scant and inadequate, and considerable test work was indicated.

On the other hand, the many possible applications of shaped charges to underground and general mining problems proved attractive enough to warrant planning and laying out test work to determine the why and how of the "Munroe effect." Some of the applications considered included the following:

Secondary breakage problems, in lieu of plastering, bombing, or mud capping.

Primary breakage in soft rock in headings, raises, or small stopes, where this breakage might be accomplished either by drilling holes into the face with shaped charges, subsequently loading and blasting the holes in the usual fashion, or, if possible, simultaneously drilling and blasting the round by means of shaped charges.

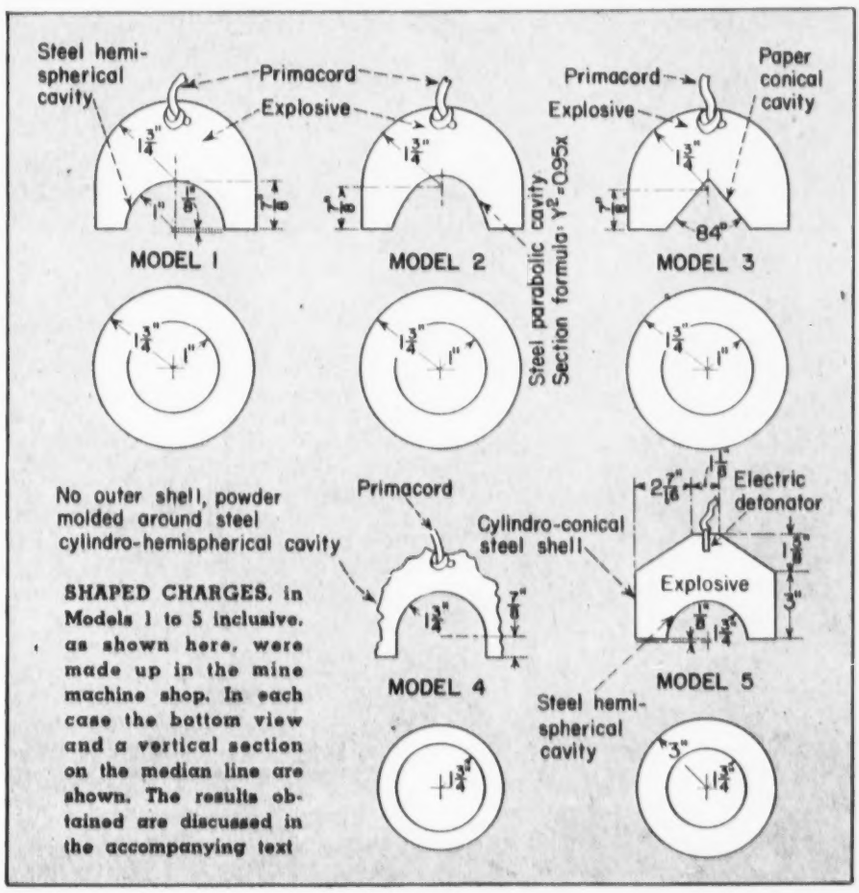
Cutting timber hitches or similar small blasting jobs, where much time might otherwise be wasted in obtaining and setting up a pneumatic drill; drilling plugs for trolley, pipe lines, or survey stations.

As an aid in barring down large, dangerous slabs of rock difficult to get at by conventional means.

To clean or expose rock surfaces both underground and on surface outcrops prior to sampling or geological examination.

Of the applications mentioned, the one which appeared to be the most logical choice for the experimental attack was secondary breakage. The choice was motivated by the following factors:

1. In large stopes where ground is hard, secondary breakage becomes

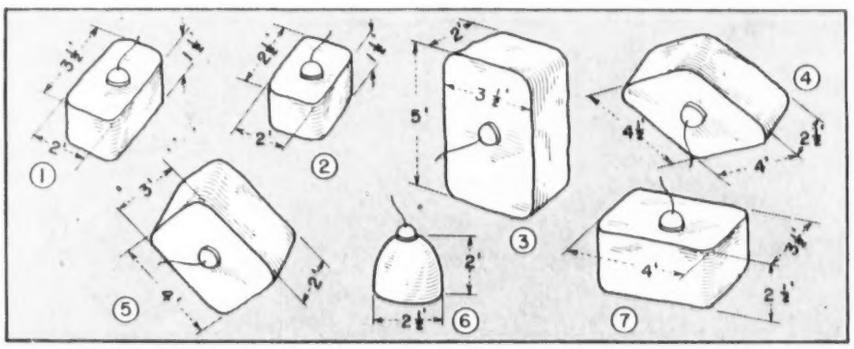



**SHAPED CHARGES, in Models 1 to 5 inclusive, as shown here, were made up in the mine machine shop. In each case the bottom view and a vertical section on the median line are shown. The results obtained are discussed in the accompanying text**

## Table I. Shaped Charge Tests, Experimental Charge, Model 1

**All charges loaded with Columbia Mine Gel No. 2, 45% powder, fired with Primacord**

| Charge No. | Cone Thickness | Shell Thickness | Stand-off Distance | Character of Rock | Estimated Rock Size, Ft. | Amount Explosive | Remarks on Results | Size of Remaining Rock Fragments | Conclusions and Remarks |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 27-gage mild steel | 27-gage mild steel | ¼ in. | Silic. and garnet. limestone | 1½, 2, 3½ | 1⅔ stick 0.6 lb. | Broke rock | Largest fragment was 2, 1½, 1 ft. Rest were 1 ft. dia. or less | Rock solidly supported on bottom of finger |
| 2 | 27-gage mild steel | 27-gage mild steel | ½ in. | Silic. and garnet. limestone | 1½, 2, 2½ | 1⅓ stick 0.5 lb. | Broke rock | Largest fragment, 1½, 1, 1 ft. | Rock solidly supported on bottom of finger |
| 3 | 27-gage mild steel | 27-gage mild steel | ¼ in. | Silic. and garnet. limestone | 5½, 3½, 2 | 1⅔ stick 0.6 lb. | Failed to break rock. Crater 8 in. in dia. and 2 in. deep resulted | | Rock wedged in finger, not solidly supported |
| 4 | Approx. 27-gage sheet steel used | Approx. 20-gage sheet copper used | ⅛ in. | Silic. and garnet. limestone | 4½, 4, 2½ | 2 sticks 0.7 lb. | Broke rock. Piece 2, 2½, 2½ ft. split but wedged in finger | Largest fragment, 2½, 2, 1 ft. | Rock wedged in finger, not solidly supported |
| 5 | 27-gage mild steel | 27-gage mild steel | 1 in. | Silic. and garnet. limestone | 4, 3, 2 | 1⅔ stick 0.6 lb. | Broke rock down center | Largest fragment, 4, 2, 1½ ft. | Possible that stand-off distance is too great |
| 6 | 27-gage mild steel | 27-gage mild steel | ¼ in. | Silic. and garnet. limestone | 2½, 2, 2 | 1⅔ stick 0.6 lb. | Broke rock into many small fragments | Largest fragment, 1, ½, ½ ft. | Rock solidly supported on muck pile |
| 7 | 22-gage mild steel | 27-gage mild steel | ⅛ in. | Silic. and garnet. limestone | 4, 3½, 2½ | 2 sticks 0.7 lb. | Broke rock. Piece 2½, 2, 1½ ft. left wedged in finger | Largest fragment, 2½, 2, 1½ ft. | Rock wedged in finger, not solidly supported |




**MANNER OF PLACING** Model 1 shaped charge on rock is illustrated for each of the seven charge tests listed in Table. I.

an important factor. As large boulders produced cannot be efficiently broken by either hand hammers or pneumatic moils, explosives must be used. These are not always used efficiently underground. Although mud capping and blockholing are relatively effective processes, it is almost impossible to apply them safely to large boulders trapped in finger raises. Even in disposing of small boulders resting on grizzlies conventional methods are not always practical. Blockholing is time-consuming, and mud caps and plasters are wasteful and destructive. The last-named, though admittedly fast methods, have met with little favor. As a consequence, plastering and bombing are resorted to. Both methods are inefficient and result in gassy working conditions in the mine, slow secondary reduction, and high powder consumption. If shaped charges could be substituted, it was hoped that they would raise the efficiency of the explosive used, cut down smoke and gas production, and, because they could be prefabricated, reduce the time required for placement of the charge.

2. Because a shattering rather than a wedging action was desirable, it was thought that boulder breaking would probably require a broad, expanding jet of gas in place of a slender, pointed, gaseous jet. It was believed that a charge which would produce a broad, semi-unfocussed jet would be the most easily designed. Boulder blasting, therefore, from an experimental point of view would be the path of least resistance.

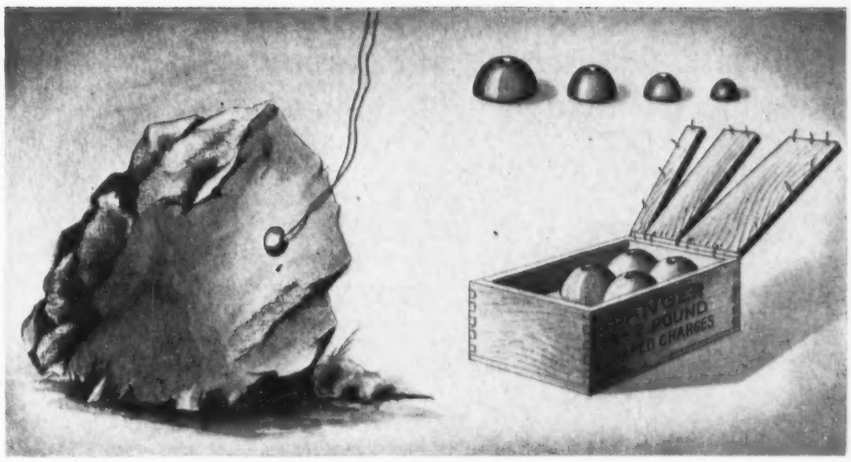
Fortunately, a short time after the idea of using shaped charges had been conceived and studied, E. O. McAlister joined the staff. During the war he had enlisted in the Navy and gone overseas. Later he had volunteered for work with underwater demolition crews in the Pacific after passing through the officers' school. He brought back many ideas as to how wartime research in explosives and the progress made therein could be put to use in metal mines. Accordingly, he was placed in charge of the experimental work which is still in progress.

What has been accomplished so far will be told in the account to follow, and there is little doubt as to the outcome. Favorable comment on the part of grizzly men and shift bosses and the demand for more "atomic booms" by crews engaged in secondary breakage are proof that the results have been good. For instance, finger hang-ups have been cleared and boulders broken up with 4½-lb. charges. Labor and expense aside from the manufacture of the shaped charges have been negligible, as have been smoke delays. Small shaped charges containing from 1⅓ to 2 sticks of powder have broken ordinary boulders on the grizzlies effectively, in contrast to the 4 to 5 sticks required with the conventional plaster charge. The explosive used in the work consisted of regular 45 percent gelatin mine powder. Results would have been better with 60 percent powder, but none of the last-named was available.

As to the charges developed, made at the property and used in various experiments underground, it is believed that the shape of the charge is all-important and not the strength of the material that supports the powder. Of considerable importance also is the distance at which the charge is held from the object against which its force is to be directed.

Actual test work on the shaped charge was started on Dec. 6, 1945, and has continued ever since. The data to be presented are those collected during the period commencing on the date given and ending early in March, 1946.

Limited tests were made on the relative cratering of five types of charges and on boulder blasting with two types of charges. The five models tested, shown in the drawings, were made at the mine machine shop. The basic features of the design of models 1 and 5 were: (1) The hemispherical sheet-iron cavity was made slightly less than full hemisphere to eliminate any gas front components normal to the long axis of the jet. (2) The outer sheet-iron shell was made of such size as to give a thick ring of explosive around the outer surfaces of the cavity. It was believed necessary, in using mine gelatin, to provide a thick ring to build up a gas-air tamp around the detonation center. The outer shells of the model 5 charges were made from 1-gal. tin cans. (3) Sizes of charges varied in uneven steps from 0.6 lb. to 4½ lb. of explosive. (4) On the premise that the charge might be used in limited spaces, a flattened, stubby-shaped charge with a zero or small stand-off distance was selected as the best design.



**LEFT. SHAPED CHARGE in place on small boulder. Right, PACKAGING could be similar to that for dynamite. Upper right, several sizes of shaped charge can be used.**

## Primacord Detonator

All charges were loaded with Columbia mine gelatin No. 2, 45 percent, 1x8-in. powder. For weight calculations it was assumed that there were 145 sticks per 50-lb. box. The charges were detonated either with Primacord or by no-delay No. 6 electric detonators, placed at the apex or top of the charges.

Boulders of ore blasted were from Nos. 3, 4, and 5 stope blocks on the 3,300 level. Rock used in cratering tests was situated in the upper extension of the same orebody on the 2,700 level. Both boulders and rock were of similar composition, and consisted of garnetized, silicified limestone with some serpentine, magnetite, pyrite, and chalcopyrite. The material was medium hard and slightly elastic to shock, but generally contained several sets of joints along which it broke easily.

The first test was made on Dec. 16, 1945, to obtain data on the effect of variations in stand-off distances, shape and size of hollow center, and amount of explosive. The model 1 shaped charge was used. A total of seven charges were tested against boulders of ore in the Nos. 4 and 5 stope blocks on the 3,300 level. Test data and results are given in Table I. Results indicate that within the limited conditions of the tests a 45-cu.ft. rock is the maximum which can be broken with 0.7 lb. of powder. The effect of the small variation of the stand-off distances could not be noted.

In the tests made on Jan. 6, 1946, model 1, 2, 3, and 4 charges were used, and the results attained are shown in Table II. All charges were spaced at 3-ft. intervals along the ribs of a crosscut on the 2,700 level. Cratering tests on these charges were run to check the effects of stand-off distance and variation in cavity shape. The charges were tied to a Primacord net, and all were detonated simultaneously. Save for shots 15 and 19, all shots were tested against rock of more or less uniform hardness. Stand-off distances on model 1, 2, and 3 charges were varied from zero to 2 in. To obtain maximum efficiency from model 2 and 3 charges, these distances should have been made larger, perhaps 4 in. It was felt that small stand-off distances would be advantageous from a practical standpoint, and as a consequence they were purposely kept small.

Results of the limited tests indicate that the best cratering, and therefore the best efficiency, were obtained from model 1 charges with a zero stand-off distance; that very poor cratering resulted from model 4 charges; and that shots 15 and 19 fired into soft rock left a crater resembling that made by military shaped charges in concrete, indicating a bunching action of the jet.

The poor showing of the model 4 charges may be attributed to the following causes: (a) Insufficient tamping or compression of the explosive around the cavity. One result of insufficient density of nitro-based explosives would be a lowering of the rate of detonation—an influential factor in the efficiency of shaped charges. (b) Improper design of the cavity of the charges. It is quite possible that the cylindrical section of the lower walls of the cavity distorted the jet resulting from detonation. Although it is impossible under the conditions which existed to visualize and understand completely the mechanics of jet formation, it does appear that the gas components moving normal to the cylindrical walls of the cavity were not smoothly absorbed into the jet stream. When preparing the charges, difficulty was experienced in molding the explosive around the cavity into a tightly compressed mass.

Model 5 charges were used in the tests made on Feb. 15 and 17 and on March 1 and 2, 1946. This charge was designed as a compromise between material available for construction and information obtained from previous tests and experience. The basic features of design are: (1) Hemispherical steel cavity which is made slightly less than a full hemisphere to eliminate any gas components normal to the long axis of the jet, obtained by cutting away the cylindrical sections of the walls

## Table II—Test Results on Experimental Charges Models 1, 2, 3, and 4

| Charge No. and Model No. | Cone Thickness | Shell Thickness | Stand-off Distance | Character of rock | Amount Explosive | Results Obtained |
|---|---|---|---|---|---|---|
| 8 Exp. Mod. 1 | 27 ga. | 27 ga. | 0 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 1.0 ft. dia. and 0.3 ft. deep |
| 9 Exp. Mod. 1 | 27 ga. | 27 ga. | ¼ in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.8 ft. dia. and 0.15 ft. deep |
| 10 Exp. Mod. 1 | 27 ga. | 27 ga. | ½ in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.8 ft. dia. and 0.1 ft. deep |
| 11 Exp. Mod. 1 | 27 ga. | 27 ga. | 1 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.8 ft. dia. and 0.1 ft. deep |
| 12 Exp. Mod. 1 | 27 ga. | 27 ga. | 1½ in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.8 ft. dia. and 0.15 ft. deep |
| 13 Exp. Mod. 1 | 27 ga. | 27 ga. | 1¾ in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 1 in. dia. and 0.2 ft. deep |
| 14 Exp. Mod. 1 | 27 ga. | 27 ga. | 2 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left an indefinite crater 0.1 ft. deep |
| 15 Exp. Mod. 1 | 27 ga. | 27 ga. | 1 in. | Soft yellow garnet | 2 sticks, 0.7 lb. | Left a crater with a 1 ft. dia. top and a 0.1 ft. dia. bottom. Melted steel from cone at bottom of crater. Crater was 0.4 ft. deep |
| 16 Exp. Mod. 1 | 27 ga. | 27 ga. | 2 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Barely scratched the surface |
| 17 Exp. Mod. 2 | 27 ga. | 27 ga. | 0 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.5 ft. dia. and 0.1 ft. deep |
| 18 Exp. Mod. 2 | 27 ga. | 27 ga. | 2 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.5 ft. dia. and 0.1 ft. deep |
| 19 Exp. Mod. 2 | 27 ga. | 27 ga. | 1½ in. | Soft yellow garnet | 2 sticks, 0.7 lb. | Left a crater with a 0.8 ft. dia. top and a 0.05 ft. dia. bottom. Melted steel from cone at bottom of crater. Crater was 0.4 ft. deep |
| 20 Exp. Mod. 3 | 1/16 in. paper cone used | 27 ga. | 2 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.5 ft. dia. and 0.1 ft. deep |
| 21 Exp. Mod. 3 | 1/16 in. paper cone used | 27 ga. | 0 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a poorly defined crater about 1 ft. dia. and 0.25 ft. deep |
| 22 Exp. Mod. 1 Check Shot for No. 8 | 27 ga. | 27 ga. | 0 in. | Garnetized and silicified limestone | 2 sticks, 0.7 lb. | Left a crater 0.8 ft. dia. and 0.3 ft. deep |
| 23 Exp. Mod. 4 | 27 ga. | No shell | 2 in. | Garnetized and silicified limestone | 4 sticks, 1.4 lb. | Left a 0.4 ft. deep crater of an indefinite area. |
| 24 Exp. Mod. 4 | 27 ga. | No shell | 4 in. | Garnetized and silicified limestone | 4 sticks, 1.4 lb. | Left an indefinite crater. |
| 25 Exp. Mod. 4 | 27 ga. | No shell | 4 in. | Garnetized and silicified limestone | 8 sticks, 2.8 lb. | Left a 0.4 ft. deep crater of an indefinite area. |

made for models 1, 2, and 3; and (2) an outer cylindro-conical sheet-iron shell of such size as to give a thick ring of explosive around the outer surface of the cavity. This was thought necessary because of the belief that, when using an explosive with a low detonation rate, excess explosive must be available to build up a gas-air tamp around the detonating center. It was thought that such a tamp may perform two useful functions; namely, (a) increase the rate of detonation of any remaining explosive, and (b) increase the velocity and thermal efficiency (temperature) of the jet, thereby increasing the penetrating and shattering power of the charge.

All the model 5 charges were fired against boulders lodged in the finger raises of the 3 and 4 stope blocks of the 3,300 level. They were propped against the boulders with blasting sticks, or were lodged between the boulders. Wire eyelets were soldered to the outer shell of each charge to facilitate tying it to the blasting stick. An error in the fabrication of charges 28, 29, 30, 31, 32, 33 and 34 (Table III) was not discovered until the material was received underground. The cavity was in the shape of a hemisphere plus about a ¼-in. cylindrical section at the bottom. Incomplete tolerance specifications given to the machine shop were responsible for the error. Although it was believed that this error would lower the efficiency of the charges, the time factors involved necessitated the decision to fire them anyway.

A study of Table III will disclose that shot 27, placed against the flat surface of a 240-cu.ft. boulder, broke it. Shot 30, which had a poorly constructed cavity, placed against a point on a 240-cu.ft. boulder, broke it in only two pieces. Boulders larger than 240 cu.ft. were not always broken by the charges, and boulders smaller than 240 cu.ft. were broken or cracked.

### What the Tests Show

Results of all tests described and given in the three tables disclose the following facts:

1. By using model 1 and 5 charges the maximum-size boulder which could be broken by 0.7 lb. of powder was 45 cu.ft., and the maximum-size boulder which could be broken by 4½ lb. of powder was 240 cu.ft. Granted that the amount of explosive necessary for breakage is proportional to the cube root of the radius of the rupture of the rock concerned (in a boulder of roughly cubic shape), it is reasonable to assume that the explosive requirement is proportional to the volume of the boulder. If this assumption is applied to the aforementioned results,

45 cu.-ft./0.7 lb. = 64 cu.ft./lb.
64 cu.ft. lb. × 4.5 lb. = 288 cu.ft./4.5 lb.

This checks within the limits of error of the experiments.

2. Craters up to 1 ft. in diameter and 0.3 ft. deep could be obtained by using the model 1 charge, and craters up to 1.5 ft. in diameter and 0.5 ft. deep with the model 5 charge.

3. Zero stand-off distances appeared to be the most efficient for model 1 and model 5 charges.

Within the limits of the tests it appears that the "Munroe effect" could be obtained (to a limited extent, at least) by using a 45 percent strength gelatin in a cavity charge,

## Table III—Shaped Charge Tests, Experimental Charge, Model 5

| Charge No. | Cone Thickness | Shell Thickness | Stand-off Distance | Character of Rock | Estimated Rock Size, Ft. | Amount Explosive | Size of Remaining Fragments | Placing of Charge on Rock | Remarks on Results | Conclusions and Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 6'x5'x5' | 13 sticks, 4.5 lb. | Largest 2'x2'x3' cracked | On flat surface underneath rock | Broke rock | Finger so plugged not all rock fragments could be examined |
| 27 | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 8'x6'x5' | 13 sticks, 4.5 lb. | Largest 2'x2½'x3' | On flat surface underneath rock | Broke rock | Finger so plugged not all rock fragments could be examined |
| 28* | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 9'x8'x6' | 13 sticks, 4.5 lb. | | On flat surface underneath rock | Failed to crack rock | Left crater 1½ ft. dia. and 1½ ft. deep |
| 29* On same boulder as No. 28 | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 9'x8'x6' | 13 sticks, 4.5 lb. | Unable to estimate size of fragments | On flat surface underneath rock | Cracked rock | Crater indistinct due to rock chipping at edges of crater. Rock still lodged in finger |
| 30* | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 8'x6'x5' | 13 sticks, 4.5 lb. | 2 pieces 6'x5'x4' | On point of rock | Cracked rock | Blew off point of rock cracked rock in two pieces, both left wedged in finger |
| 31* | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 4'x6'x7' | 13 sticks, 4.5 lb. | Largest 3½'x3'x2' | On flat surface end of rock | Broke rock | Rock still wedged against other rocks in finger |
| 32* | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 4'x5'x6' | 13 sticks, 4.5 lb. | Largest 1½'x1½'x1' | On flat surface underneath rock | Broke rock | |
| 33* | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 9'x7'x6' | 13 sticks, 4.5 lb. | | On flat surface underneath rock | Failed to break rock | Left crater 1 ft. dia. and ½ ft. deep |
| 34* | 24 ga. | Standard tin plate | 0 in. | Silic. and garnet. limestone | 6'x6'x6' | 13 sticks, 4.5 lb. | Shake made visibility too poor to get estimate | On flat surface on face of rock | Broke rock | Rock was at bottom of finger, solidly supported and surrounded (except on one face) by comparatively fine muck, cracked fragments of rock remained in place. |

*Poorly shaped cavity probably caused inefficiency in charges.

and that with model 1 and model 5 charges a maximum of about 50 cu.ft., or 4 tons of rock, could be broken per pound of explosive.

General conclusions regarding boulder blasting to be drawn from the work described include the following:

Powder consumption for maximum-size boulders broken by the blasting methods ordinarily employed at the National Tunnel & Mines property (bombing and plastering without tamping) has been estimated to average about 1 lb. of explosive per 12 to 18 cu.ft. of rock broken, or 1 lb. of explosive per 1 to 1½ tons broken. As stated previously, the tests show that by using model 1 and model 5 charges, 1 lb. of explosive will break about 50 cu.ft., or about 4 tons of rock—an explosive saving of more than 60 percent. This reduction in explosive would result in less burden on the ventilation system, and decreased gassy working conditions.

Obvious, also, is the fact that if prefabricated shaped charges are used to replace hand-assembled plasters and bombs, the saving in labor on the grizzlies and in the fingers would be considerable.

It is also true that the shaped charges tested were incomparably less efficient than shaped charges which could be designed and made if proper knowledge, reseach facilities, and explosives were available. Shaped charges undoubtedly can be prefabricated cheaply, provided they are manufactured on a large scale. With additional development and test work there can be no doubt that shaped charges will prove useful for secondary breakage on grizzlies, in finger raises and in scram drifts.

In this regard the following suggestions for development of the proper shaped charge are offered.

### Improvement Possible

1. The problems of cavity shape, stand-off distance, and explosive content of the charges must be attacked by relatively large-scale tests. Attempts should be made to obtain a charge with the greatest shattering rather than splitting effect. Rock, and boulders in particular, should be the testing medium.

2. Permissible explosives with higher rates of detonation should be sought. A 60 percent strength dynamite should prove more efficient than the 45 percent strength dynamite used in the tests.

3. The container which holds the explosive charge may possibly be made from plastic or pressed cardboard rather than light metal, thereby reducing the cost and increasing the safety of the charges.

Methods of holding the charge against the rock to be blasted are particularly important from the standpoint of time. The charges should be provided with a sticky face, so that they may be pressed against the flat surface of a boulder and adhere. This would be especially advantageous in breaking small boulders, where numerous charges must be placed quickly. The larger charges should be provided with rings and straps so that they may quickly be attached to blasting sticks of different sizes. The charges should be made in ½ lb., 2 lb., 5 lb., and 10 lb. sizes. Charge packaging is necessary for handling the charges and a 50-lb. box is suggested.

# Federal Mine Taxation

**The effect of taxes on mineral enterprise is so profound, and so ominous for the future, that we recommend reading of the Mining and Metallurgical Society's resolution and the accompanying explanation to every member of the industry.—The Editors.**

## FEDERAL TAXATION OF MINERAL ENTERPRISE

***A Resolution of the Mining and Metallurgical Society of America***

The members of this Society believe that a dynamic and prosperous mining industry is essential to a sound national economy in the future, is necessary to the national defense and security and is therefore vital to the public interest.

We also believe that a vigorous and flourishing general economy is equally essential to a dynamic and prosperous mining industry.

It is our belief that the existence of a sound and prosperous general economy and mining industry, capable of producing the maximum revenues which the future needs of our government and the servicing and amortization of the national debt require, is dependent upon adequate incentives.

The known ore reserves in the United States have been seriously depleted by the demands of the war effort and prompt action to replace these reserves by new discovery and development is essential in the national interest.

Adequate incentive cannot exist unless the tax system is so constructed as to encourage investment of risk capital in new enterprises, the development of new properties, uses, and processes, and the creation of maximum production and employment.

The Mining and Metallurgical Society of America hereby urges the adoption by Congress at an early date of the following changes in the Federal tax system as necessary to create such incentive and to remove existing clogs upon the expansion and development of mining and other business enterprises:

1. Full and adequate allowance should be made for the tax-free recovery of capital out of profits, including liberal allowances for depreciation and obsolescence reasonably administered. Provision should be made that depreciation rates established and consistently applied by the taxpayer should be accepted except to the extent that the Commissioner establishes that such rates are excessive.

2. Adequate provision should be made for offsetting the losses of bad years against the profits of good years over a reasonably long period. With this end in view, section 122 of the Internal Revenue Code should be revised so as to eliminate certain technical adjustments and limitations it now contains which operate to penalize taxpayers having loss years as compared with those whose profits are distributed more evenly over the given period.

3. The Internal Revenue Code should be amended so as to permit the treatment as current expense, and the deduction of amounts expended in scientific research and experimentation, in the development of new processes and products, and in the exploration and development of new orebodies and ore reserves.

4. In order to stimulate adequate investment of equity capital in hazardous mining enterprises and provide a reasonable opportunity of tax-free recovery of such shareholder capital, provision should be made for the distribution of depletion reserves to stockholders tax-free.

5. The double taxation of corporate profits should be eliminated by provisions which will allow shareholders receiving taxable dividends a reasonable credit on account of corporate taxes paid.

6. The tax upon intercorporate dividends should be repealed, as well as the penalty tax imposed upon corporations filing consolidated returns.

7. The imposition of corporate taxes upon or with respect to undistributed profits of business corporations should be avoided.

8. The tax system should be made more intelligible to the ordinary business man. Its structure should be simplified by the elimination of unnecessary taxes and in all other practical ways. We commend the recent repeal of the excess profits tax and the capital stock and declared-value excess profits taxes from the points of view of removing clogs upon incentive and of simplification of the tax system.

9. An earnest effort should be made to enact as promptly as possible a reasonable, equitable, and well-balanced plan of taxation which can be continued in force for a number of years without the necessity of continually recurring substantive changes. The goal should be a sound and stable tax system.

10. Every effort should be made to improve the quality of administration of the tax laws and thereby to win the confidence of taxpayers that the tax laws will be fairly and equitably administered. The present administrative tendency to disregard legislative intent under the guise of administrative interpretation should be discouraged. Long-established administrative interpretations and procedures should not be modified or reversed unless such action is compelled by a change in the statute or by authoritative judicial decision. The frequent adoption of inconsistent positions on the same issue in different cases is inimical to public confidence in the fairness of the administration of the revenue laws, and this unfortunate practice should be restricted to an unavoidable minimum.

# Should Provide Incentives

## Explanation of Resolutions:

FIRST AND FOREMOST is the principle that income taxation should fall only on profits and not be so applied as to tax capital. The second is that the system and rates of taxation imposed on profits must be such as will leave to the investor, after taxes, the opportunity for profits sufficient to justify the risk, the skill, the effort, and the investment required. The following points are essential to carrying out these principles:

**Depletion Must Be Fully Recognized.**—The present allowance based on recovery of cost or discovered values or on percentages of income should not be reduced. There are no profits from mining unless there is full recovery of the capital investment. The cost to the taxpayer of the single property may not be indicative of the actual capital employed. The one property thus acquired may represent years of effort and experience. There are more failures than successes. Mines are not self-perpetuating, but when exhausted can be replaced only by search and discovery of other properties. A mine operator cannot change his product. He cannot importantly influence his profits by changes in style or packaging or advertising or by the thousand and one ways open to the manufacturer or merchant. To measure all of this exactly by fixed formula is quite impossible. We have established the principle that under no circumstances should the depletion allowed be less than the amount necessary for recovery of the basic value of that property. Mines may sometimes be able to show clearly the measure of allowance necessary for such recovery. Under other conditions it is exceedingly difficult and even impracticable to do so. For such mines, provision is made either for percentage depletion at specified rates which the law allows for minerals specified therein or for discovery depletion in considering mines not so specified. Even such allowances often prove inadequate to permit full recovery of capital investment. If there is any criticism to be made of present percentage depletion allowances, it is that the percentage allowed frequently is not sufficient to meet its intended purpose.

Furthermore, we have recognized generally in our tax laws that a long-term capital gain should not be subjected to as high a rate of taxation as is applicable to ordinary income. The current operation of a mine necessarily represents the exhaustion of a capital asset and its profit is effectively the realization of long-term capital gain.

A first requirement of any income tax law applied to the mining industry should accordingly be that full recognition is given to the depletion principle.

**Full and Adequate Allowance Should Be Made for Tax-Free Recovery of Capital Investment in Plant and Equipment.**—Because of the Bureau's present reluctance to recognize obsolescence in setting depreciation rates, adoption of improvements arising from progress of the art is gravely retarded. To correct this tendency, obsolescence due to changes in processes and methods should be fully recognized in determining depreciation allowances. The cost of plant and equipment can be recovered only out of profits, not out of losses. Therefore, no depreciation should be considered to represent a recovery unless it represents an effective reduction in taxable income. The appropriate allowance to be made for each year is a matter of judgment rather than exact determination. There is no one particular method which best determines the depreciation actually sustained. The taxpayer should be permitted to take liberal allowance for depreciation and the amounts claimed by the taxpayer should be allowed unless the Commissioner establishes that such allowances are not reasonable.

**The Losses of Poor Years Should Be Fully Offset Against the Profits of Good Years.**—Unless this is done, the income tax in the long run will be imposed on more than the net income from the property. The losses should be fully deductible with the same effect as if the profits and losses had been incurred in a single taxable period.

Mines are particularly subject to wide fluctuations in operating results. A mining company can do little to offset the effects of declines in the market prices of its products. Its "raw material costs" are fixed by the costs of its mines and development. It normally cannot substantially curtail its production solely because losses are being incurred.

It is the expected net profits, over the life of the mine, including good years and poor years, which must furnish the incentive for risk investment. Such net profits are the amounts remaining after replacement of capital and after taxes taken by the Government. Our system of imposing income taxes by annual income periods should not be made to impose such taxes on more than the long-run net profits of a mine.

Under present law, in computing a net operating loss carry-over or carry-back deduction, deductions for percentage and discovery depletion are not taken into account, and dividends received are treated as fully taxable income for the year of loss and for any year against which the loss might be applied. This may deny or abridge the loss carry-over or carry-back and result in imposing an income tax higher than would have been imposed had the same long-run net profits been realized but without loss years. Taxpayers having loss years should be no more heavily taxed than taxpayers having the same net profits distributed more evenly over the given period.

**Exploration, Development, and Research Should Be Allowed as Operating Costs or Expenses.**—The preservation of the mining industry requires continual search for new orebodies, exploration and development of new prospects, extended exploration and development of previously known mines and the continuing scientific research and experimentation for new or better processes of production and recovery of minerals and new or improved products in which the minerals may be of use to mankind. These are the ordinary incidents in the life of the mining industry, and the expenditures therefore should be recognized as ordinary and necessary expenses or operating costs from the tax standpoint. So-called preliminary development expense

of a mine (incurred before the mine reaches the production stage) represents expenditures for extraction of the ore just as clearly as does development expense incurred contemporaneously with the ore production, and should be allowed as a cost of mining the ore.

**The Stockholder Should Also Be Permitted to Recover Tax-Free His Investment in Capital Stock of a Mining Corporation.**—Because exhaustion of the mine applies with equal force to the stockholder as well as to the corporation, the stockholder should have adequate allowance for capital recovery.

The stockholder's basis for his stock may substantially exceed the corporation's basis for the property, particularly where the stockholder has bought his stock after the discovery and development of the mine which the corporation had acquired as an undeveloped prospect or a partly developed mine. Yet the stockholder under present law may receive little, if any, recognition of the fact that distributions he receives from a mining company represent in part a liquidation of his capital investment. Theoretically, each stockholder should be permitted to allocate all distributions received as between recovery of capital and income thereon according to his own investment in that stock. Probably it is not practical administratively that this should be done. The remedy would seem to be either to permit the stockholder to apply all distributions received from the mining corporation as a return of capital to him until his investment in the stock has been recovered or to fix some more or less arbitrary percentage of the distributions which might be credited as return of capital, or at least to permit all distributions made from depletion reserves, including percentage and discovery depletion, to be distributed to stockholders tax-free.

**The Cumulative Double Taxation of Corporate Profits Distributed as Dividends Should Be Eliminated.**—Preferably this should be done by allowing to shareholders receiving taxable dividends a credit on account of the corporate taxes theretofore paid on the earnings from which distribution is made. When corporate earnings are taxed at 38 percent, if the remaining 62 percent is distributed to stockholders taxable at 50 percent, a further 31 percent will be taken; so the combined corporate-individual tax in such case will take 69 percent and leave to the stockholder only 31 percent of the earnings of the mine. The mine thus would have to earn an average of 20 percent on its investment to yield to the stockholder 6 percent net thereon, which generally will be inadequate to warrant the risk investment.

The tax to be paid by the stockholder on dividends received by him should take into account the tax previously paid by the corporation and the stockholder should be taxed only to the extent that his individual income tax rate would be in excess of that which had already been paid by the corporation on the profits thus distributed.

This principle should also be applied to the tax on intercorporate dividends. When a corporation is a stockholder, income is taxed three times—when earned, when distributed to the stockholder corporation, and when distributed, in turn, to its stockholders.

The consolidated return of affiliated companies presents the most realistic and accurate picture of operations. The penalty tax of 2 percent imposed upon consolidated income should be eliminated.

**No Undistributed Profits Tax Should Be Imposed.**—Practically all successful enterprises from which revenues flow to the Government have been built up from accumulated earnings. There should be no attempt to force distribution of funds which good business judgment dictates should be retained for the needs of the business. No penalty tax should be imposed because earnings are retained for sound corporate purposes.

If in addition to the income tax a penalty tax of 20 percent to 40 percent is imposed because earnings are retained for business use, management would generally find it difficult to justify the retention and use of such funds regardless of the soundness of purpose. For example, if failure to distribute earnings would subject the property to a 38 percent tax which would not be payable if earnings were distributed, and the management wished to retain $100,000 for use in development and expansion of the business, it would have to retain $161,290 in order that after payment of a 38 percent tax of $61,290 it would have left the $100,000 needed for business use. The payment of $61,290 in tax in order to have $100,000 retained for use in the busness is a heavy penalty, generally prohibitive, against retention of earnings for business use. Any such penalty tax must be expected to discourage the building up of profitable enterprises which would help meet Government needs for long-term revenues.

**The Tax Laws, Regulations, and Administration Should Be Simplified and Made More Intelligible to Ordinary Business Men as Taxpayers.**—Commendable steps have already been taken to remove brakes upon incentive and simplify the tax system through repeal of the excess profits tax and the capital stock and declared value taxes. It is recognized that tax laws and regulations necessarily become technical and complicated, but every effort should be made to have a tax system so formulated, expressed in law, and administered that as applied to any industry it will be reasonably understandable to the ordinary intelligent business man engaged in that industry. Greater recognition should be given to the management's determination of income for credit purposes, or for reports to stockholders or the Securities and Exchange Commission which are prepared in accordance with methods and procedures appropriate to the industry and may be accepted as reflecting fair and consistent representations.

**A Stable Tax System Required.**—There should be earnest endeavor to establish as promptly as possible a reasonable, equitable, and well-balanced plan of taxation which can be continued in force for a number of years without the necessity of continually recurring substantive changes. Only under such a tax law can business men intelligently plan their affairs. Prospect of continually recurring tax changes is disturbing and does not promote the confidence necessary to warrant plans for new investment, expansion, and development. Every effort should be made to improve the quality of administration of the tax laws and win the confidence of taxpayers that the laws will be fairly and equitably administered. The administration should be as ready to deal fairly with taxpayers and recognize their rights as it is to enforce the Government's right to its revenues. Long-established administrative interpretations and procedures should not be lightly disturbed. Frequent changes in rulings and interpretations, particularly when given retroactive effect, and adoption of inconsistent positions on the same issue in different cases, does not encourage

(*Continued on page* 142)

# New Flotation Technique In Copper-Lead Separation

**G. O. DESHLER,** Assistant General Superintendent; **T. R. HERNDON,** Mill Superintendent, San Francisco Mines of Mexico, Ltd., San Francisco del Oro, Chih., Mexico

SEPARATION OF CHALCOPYRITE BY FLOTATION from a bulk galena-chalcopyrite concentrate is accomplished at the San Francisco Mines of Mexico, Ltd., by a method quite different from that commonly used. In developing the technique, which has now been used successfully for more than two years, many problems had to be solved, and a discussion of a few of the major ones may prove helpful to others.

Ores milled at Frisco carry from 0.6 to 0.9 percent copper, principally chalcopyrite, with a general average of about 0.8 percent. (See Table II.) The lead-copper ratio is of the order of 8.5 to 1, although this varies from day to day.

Because a lead rougher table concentrate, running about 70 percent lead and 0.4 percent copper, is removed ahead of flotation, the lead-copper ratio in the flotation feed is somewhat lower than in the ore. The result is a lowered lead-copper ratio in the bulk lead concentrate, a condition favorable to subsequent lead-copper separation.

A high total copper recovery in the copper concentrate cannot be made, because only 74 percent of the ore's copper ever reaches the copper section. The zinc concentrate carries about 14 percent of the total copper in the form of tetrahedrite in microscopic seams in the sphalerite, which is not liberated at minus 200 mesh. The mill tailing runs 0.11 to 0.13 percent copper and carries about 12 percent of the total. Here the copper is associated with the pyrite, which is depressed in the zinc section and discarded in the tailing.

These values have been quite uniform through the years, changing but little with variation of copper content of the ore. It is easily seen, then, that an increase of copper in the mill heads above the minimum will be reflected in a disproportionate recovery of copper in the copper concentrate, because copper losses in zinc concentrate and mill tailing remain almost constant.

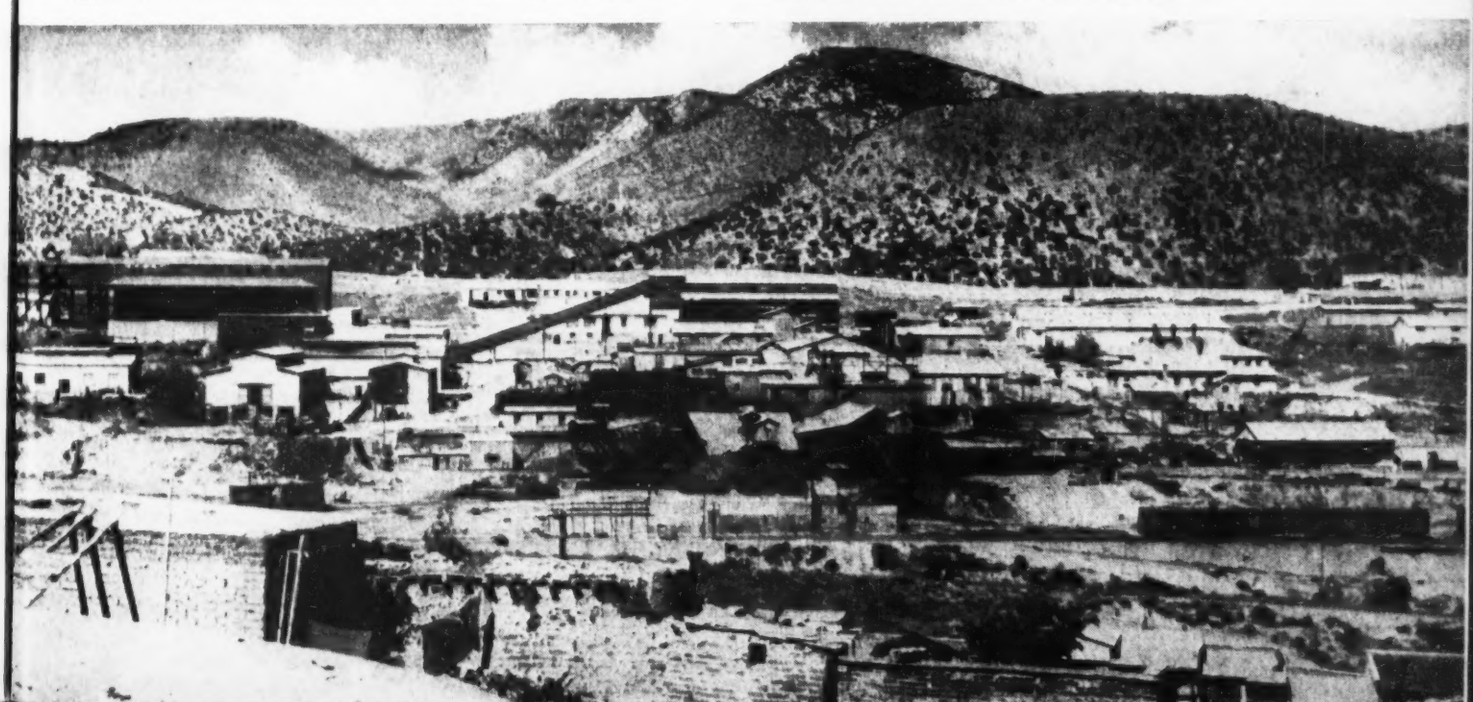
It was decided, therefore, that there would be no advantage in treating the whole mill tonnage to produce a copper concentrate, but that a product should be selected somewhere in the flowsheet which would have the lowest lead-copper ratio and be in condition for floating. The final bulk lead-copper concentrate, which carries a minimum of zinc, was selected.

Through the years many attempts had been made in the laboratory to devise a lead-copper separation that would have a reasonable chance if introduced into the mill, but with no success.

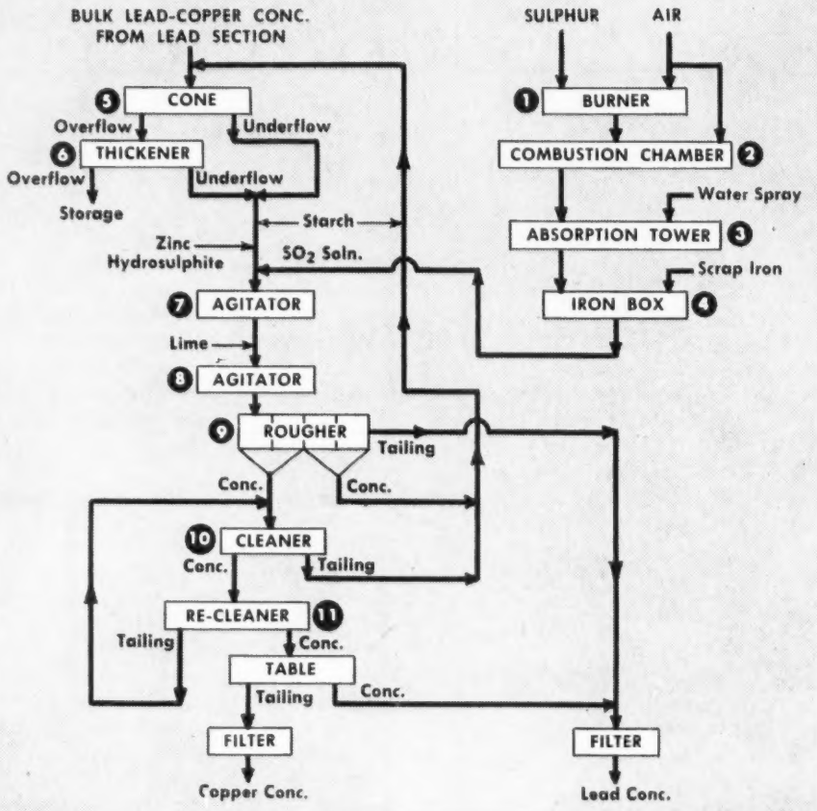
The commonly accepted methods did not seem to work, and it was not until the Dow Chemical Co. sent in a quantity of zinc hydrosulphite that a glimmer of light was seen. This salt seemed to promote the flotation of chalcopyrite by cleaning the mineral surface, some of which is badly tarnished, and at the same time to inhibit the flotation of zinc, and, to some extent, of the lead. However, the consumption of this salt seemed to be too high to be practicable.

Zinc hydrosulphite is unstable, constantly giving off $SO_2$ fumes on

**THE EXTRA VALUE** of being able to market separate lead and copper concentrates, instead of one bulk lead-copper product, is obtained in the mill of San Francisco Mines of Mexico, Ltd., by conditioning pulp with $SO_2$, then floating chalcopyrite.



## GALENA-CHALCOPYRITE SEPARATION SAN FRANCISCO MINES OF MEXICO, LTD.




*LEGEND*

1. Sulphur burner, 28-in. diam. x 7 ft. Air at 2-lb. pressure.
2. Combustion chamber, 30-in. diam. x 4 ft.
3. Absorption tower, 4 ft. 6 in. square x 16 ft. (coke).
4. Iron box, 3 ft. square x 16 ft.
5. Cone, 3 ft. diam.
6. Dorr thickener, 30 x 10 ft.
7. Agitator, eight 18-in. M.S. cells (acid-proof; pH of 3.0).
8. Agitator, 8 x 10 ft. (To pH, 6 or 7).
9. M.S. flotation cells, four 24-in., sub-aerated.
10. M.S. flotation cell, one 24-in.
11. M.S. flotation cell, one 18-in.

standing. This suggested the possibility that $SO_2$ gas might serve to displace, in part at least, the zinc hydrosulphite. Perhaps the gas was an active factor. This was borne out in experimental work, and, not to go into too much detail, a scheme was worked out which gave, at will, a high-grade copper concentrate and a high-grade lead concentrate, with satisfactory recovery of the copper.

The laboratory work indicated that the pulp should be ground in a ball mill with the zinc hydrosulphite, and a copper concentrate could then be floated off, without trouble, at almost any pH. This was not borne out in practice.

The scheme looked promising enough to warrant a full-sized unit in the mill to handle the total product. Any experimental work necessary could then be conducted on a full scale and laboratory work tied in immediately with operation. The section was built to handle 200 to 250 tons a day.

## Mill Operation

The flowsheet of the section as originally built followed the laboratory procedure. Trouble soon developed, however, and it took a period of nine months of alterations, additions, and tests until a smoothly operating unit, producing good results, was evolved. It would serve no useful purpose to recount all the changes made; but one, which seemed very interesting, might be mentioned.

At one time, when it became apparent that a longer period of agitation with $SO_2$ gas was needed, 8 cells of a 20-cell 18-in. M. S. machine were modified to serve this purpose. These machines were equipped with white iron liners and impellers. Results were bettered appreciably.

In the course of time, the white iron liners were worn out and replaced with concrete, and somewhat later the impellers were replaced with wood. Operations about then became poorer and poorer, and nothing that was done seemed to help.

The suggestion was finally made that ferrous sulphite resulting from contact of the old iron fittings and the sulphurous acid might have been of assistance in the process. Laboratory tests with ferrous sulphite seemed to bear this out. A large box was then filled with scrap iron and the $SO_2$ solution passed through it before entering the agitator. Operation came back to normal immediately, and this step has proved to be most useful in maintaining a smooth and free flow of froth.

## Method Used

The bulk lead-copper concentrate from the lead flotation section is pumped to a 5-ft. settling cone, the overflow going to a 30-ft. Dorr thickener. The underflow of both the cone and thickener, having 50 percent and 30 percent solids respectively, join, and flow directly to the agitator, which, as stated before, consists of 8 cells of a 20-cell, 18-in., M. S. machine, suitably modified. The cells are concrete-lined, the impellers are of brass, and the steel shafts are covered with lead by means of a metal spray gun.

Starch, zinc hydrosulphite, and the sulphurous acid solution, after passing through the "iron box," here join the pulp as it flows to the first cell of the agitator. Agitation time is 15 minutes, and the pH of the pulp upon leaving is 3.0. It would be impossible to operate at this acidity, because all the minerals would float; therefore hydrated lime is added, and the pulp agitated, to bring the pH to between 6 and 7. At this point the chalcopyrite floats and the galena and sphalerite are depressed.

The flotation unit is simple, consisting of four 24-in. M. S. "rougher" cells, one intermediate cleaner of the same size, and one final 18-in. cleaner. The flow is the usual counter-current one with modification, as shown on the flowsheet. Tailing of the rougher section constitutes the final lead flotation concentrate, and is pumped to the lead filter section.

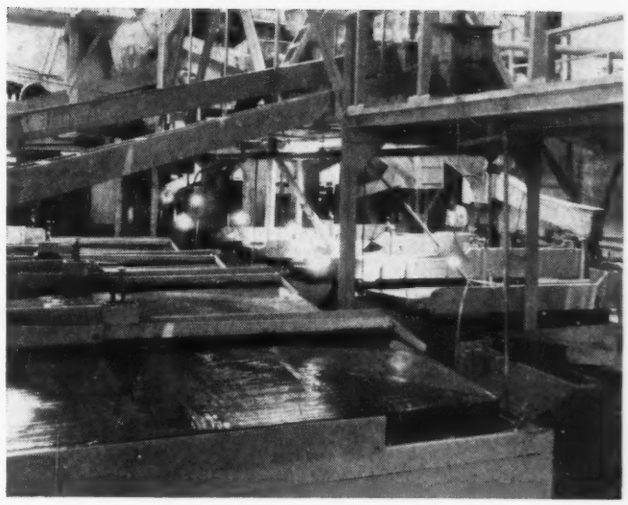
The copper concentrate from the

## Table I. Reagents Used for Copper Flotation

| | Kg./Metric Ton | Lb./Short Ton |
|---|---|---|
| Zinc hydrosulphite | 0.039 | 0.078 |
| Sulphur | 0.237 | 0.474 |
| Starch | 0.037 | 0.074 |
| Lime | 0.457 | 0.914 |
| Pentasol alcohol | 0.001 | 0.002 |

## Table II. Mill Results for Fiscal Year 1944-45

| | Tons | Au Gm | Ag Gm | Pb Percent | Cu Percent | Zn Percent |
|---|---|---|---|---|---|---|
| Heads | 568,750 | 0.908 | 176.1 | 6.83 | 0.81 | 9.43 |
| Pb conc. | 55,396 | 4.326 | 1236.2 | 61.04 | 1.92 | 9.87 |
| Cu conc. | 9,242 | 2.734 | 1069.4 | 6.85 | 25.20 | 6.30 |
| Zn conc. | 69,435 | 0.984 | 174.5 | 2.01 | 0.99 | 55.07 |



**LEAD-COPPER RATIO** in Frisco's flotation feed is reduced by removing high grade lead concentrate on these Deister Plat-O tables. Lowered lead-copper ratio makes subsequent separation easier.

final cleaner is sent over a table. This serves as a pilot table, although a small amount of lead is cut out and joins the lead concentrate. The tailing of this table constitutes the copper concentrate and is sent to the copper filter section.

## Reagents

*Sulphurous Acid Plant.* A sulphur burner, combustion chamber, and absorption tower supply $SO_2$. The burner is a cylindrical cast-iron unit 28 in. in diameter by 7 ft. long, fitted with a pipe at one end for charging. Approximately 40 lb. of sulphur per hour is burned under 2-lb. air pressure. The gas passes from the burner to a combustion chamber 30 in. in diameter, 4 ft. high, also equipped with an air intake. This is important because it provides a chance for combustion to be completed should the temperature in the burner rise and sulphur distill over.

From the burner unit, the $SO_2$ gas passes to a wood absorption tower 4 ft. 6 in. in section by 16 ft. high. The gas enters directly below a slatted wooden platform that supports the coke with which the tower is filled. The column rests in a water seat; therefore, the gas passes up through the coke and meets the descending water, which is sprayed over the top of the coke.

Absorption is practically complete. The sulphurous acid solution is used quite dilute at about 0.3 percent $SO_2$. This is controlled by half-hourly titrations, using a standard potassium permanganate solution.

From the water seal the solution flows to the "iron box," which is a rectangular wooden box 3 ft. in section by 16 ft. long, fitted with baffles, and filled with light iron scrap. A certain amount of ferrous sulphite is formed here, and the solution is then ready for the agitators.

*Zinc Hydrosulphite* acts as a zinc depressant and seems to have some effect in stabilizing the froth.

*Starch* is the common commercial cornstarch, put into solution under steam pressure. It is a powerful depressant of lead and copper and has to be used with care. The pulp is thoroughly dispersed by its use, and a large portion of the slime lead, which might be carried mechanically by copper bubbles, is inhibited.

*Amyl Alcohol* (*Pentasol*) is used occasionally when a slight frother is desired.

*Lime* used is a commercial grade of finely ground hydrated lime, 50 percent water soluble, fed by means of a dry belt feeder.

## Control

As the feed to the section is all minus-200 mesh, with approximately 80 percent minus-325 mesh, it is important that the density to the flotation circuit be carefully controlled at 10 to 15 percent solids. A dilute dispersed pulp is essential for successful work.

The pulp leaves the agitator after contact with the $SO_2$ solution at a pH of 3. At this acidity the minerals would all float. The function of the lime is to bring the pulp to a pH between 6 and 7, preferably to about 6.4, at which point the galena and sphalerite are depressed and the chalcopyrite is floated. Readings are taken with a Roulette comparator.

The feed to the copper section, which, as stated before, is the final flotation lead concentrate from the lead flotation section, varies from day to day, depending on the ore being treated. It may be rather low grade, such as 51 percent Pb, 11 percent Zn, and 4.6 percent Cu; or it may reach 56 percent Pb, 9 percent Zn, and 6.5 percent Cu. To some extent, but not entirely, this reflects the work done in the lead section. A high lead-copper ratio in the mill heads produces a similar condition in the feed to the copper section. It is possible to produce a feed carrying less zinc, but at the expense of silver recovery.

It is possible, also, to produce almost any grade of concentrate up to 31 percent Cu, but a grade of 25 to 26 percent has been decided upon as giving the most uniform and best recoveries. It is not necessary to go to any extreme in this connection, because unrecovered copper here is paid for in the lead concentrate, although at terms not quite so advantageous.

The constant loss of copper in the zinc concentrate and the mill tailing amounts to approximately 26 percent.

Because the total copper recovery is 74 percent, and 50.26 percent of the total copper is recovered in the copper concentrate, the indicated recovery of copper going to the copper section is about 68 percent. This does not seem large, but it does give a welcome addition to the over-all economic return.

We wish to express our appreciation of the permission of the management of San Francisco Mines of Mexico, Ltd., to publish this information.

# Allied Council Restricts German Metal Output

**JOHN D. WILSON,** Economics Staff, McGraw-Hill Publishing Co., Inc.

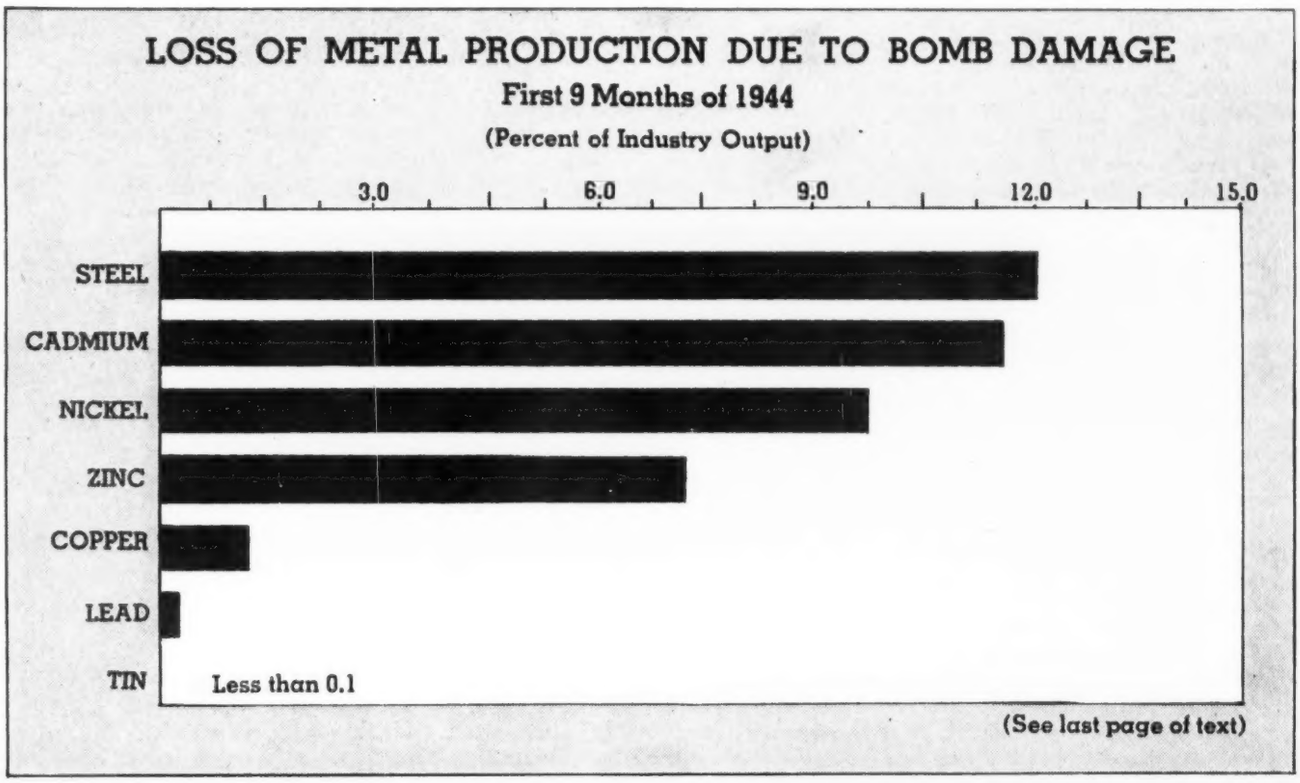
**Germany's production and consumption of minerals are to be limited to a fraction of prewar levels. Large quantities of excess equipment will be tagged for reparations, much of which will go to Russia. Mining men wonder whether the rest of Europe can be well off with Germany poor. The answer will affect mining and metal producers throughout the world.**

EUROPEAN MINING will be profoundly affected by the drastic change in the German economy proposed in an agreement now reached by the Allied Control Council. After months of vigorous debate, the Control Council has finally set the output of minerals and other products that German industry will be permitted to turn out or to import in the postwar world. In accordance with the Potsdam agreement, a large number of industries are to be completely abolished and the capacity of another sizable group is to be severely restricted. The net result will be a substantial reduction in Germany's production and consumption of all minerals, with the output of all metal-consuming products cut to less than half of its 1936 level. An inevitable corollary will be the forcing of many Germans from mining and industry into agriculture if the country is to escape starvation.

The agreement as it now stands rests on the assumption that Germany will remain a single economic unit. If the French are successful in their effort to detach the Ruhr area of the Rhineland from Germany, or if any other territorial changes finally occur, output and consumption for the whole of the area Germany now embraces may be changed from the levels presently set. Nevertheless, some blueprint of the peacetime German economy is an essential first step toward the earmarking of mining and industrial equipment that will be available for reparations. Such a blueprint now has been approved by the occupying powers, and further action looking toward the disposal of surplus German equipment will be based upon it.

## Many Minerals Prohibited

A number of minerals important to war but not absolutely essential for peactime products are to be completely eliminated. The list includes primary aluminum, magnesium, beryllium, and vanadium produced from Thomas slags, and the various radioactive materials. Still other



metals that are necessary to both war and peacetime output are to be severely curtailed. Steel is the basic metal within this group, and decisions regarding it have affected the ferro-alloys and non-ferrous metals. Wide divergences of opinion between England and the U.S.S.R. were finally compromised in an agreement to limit steel production to 5,800,000 tons, about one-fourth the 1938 volume. Consumption of iron ore, as well as such ferro-alloy metals as manganese and molybdenum, will of course be reduced in like degree. Of the various non-ferrous metals, the use of copper in the new German economy is to be restricted to slightly less than one-third of the 1938 volume, and only about half the prewar total of zinc, lead, and tin is to be available. Furthermore, nickel supplies that will be available will be less than one-seventh of the annual consumption of the German requirement in the late thirties.

This is the general picture of what is to be Germany's changed mineral supply. But its full significance can be assessed only against the background of Germany's position in the whole of the European mineral economy, a position which changed radically during the course of the conflict.

German aluminum production shot up rapidly during the thirties. Even before intensive war preparations were started, German output of 97,200 metric tons matched that of the United States and accounted for 55 percent of the total in Europe. France, Norway, Switzerland, and Italy were the other European producers, but all were small when compared with the production of Germany.

After the outbreak of war, Germany continued its expansion of aluminum capacity. In spite of the ravages of war, production reached its peak in late 1944, when a record output of 300,000 metric tons of primary aluminum and 118,000 tons of the secondary metal was achieved. In part this continued advance was realized through transfer of equipment from France and Norway. Imports into Germany from these and other countries declined to a mere 19,000 tons, whereas in 1941 they had stood at 50,200 tons. A large share of imports came from Norway, to which Germany shipped alumina for the final stages of production. At one time the Reich sought to expand Norwegian capacity, but the difficulties encountered in producing the necessary equipment within Germany defeated the plan.

**Table I. Source of Germany's Light, Non-Ferrous and Ferro-Alloy Metal Ores, 1938**

| | Percent of Total Ore Supply | | |
|---|---|---|---|
| | | Imports from | |
| | Domestic Production | European Areas | Non-European Areas |
| **Light metal** | | | |
| Bauxite | 0.0 | 84.5 | 15.5 |
| **Non-ferrous metals** | | | |
| Copper | 9.4 | 13.8 | 76.8 |
| Lead | 49.9 | 18.5 | 31.6 |
| Zinc | 83.6 | 1.2 | 15.2 |
| Tin | 15.0 | 0.0 | 85.0 |
| Cobalt | 66.7 | 0.0 | 33.3 |
| Antimony | 1.8 | 29.6 | 68.6 |
| **Ferro-alloy metals** | | | |
| Nickel | 11.9 | 3.0 | 85.1 |
| Molybdenum | 0.0 | 4.0 | 96.0 |
| Chrome | 0.0 | 52.0 | 48.0 |
| Vanadium | 25.0 | 0.0 | 75.0 |
| Manganese | 0.0 | 15.1 | 84.9 |
| Tungsten | 0.0 | 7.8 | 92.2 |
| Titanium | 0.0 | 96.9 | 3.1 |

Source: Monatliche Rohstoffübersichten, Statistisches Reichsamt, Abt. VIII, Industrielle Produktionsstatistik, reproduced in "The Effect of Strategic Bombing on the German War Economy," p. 109.

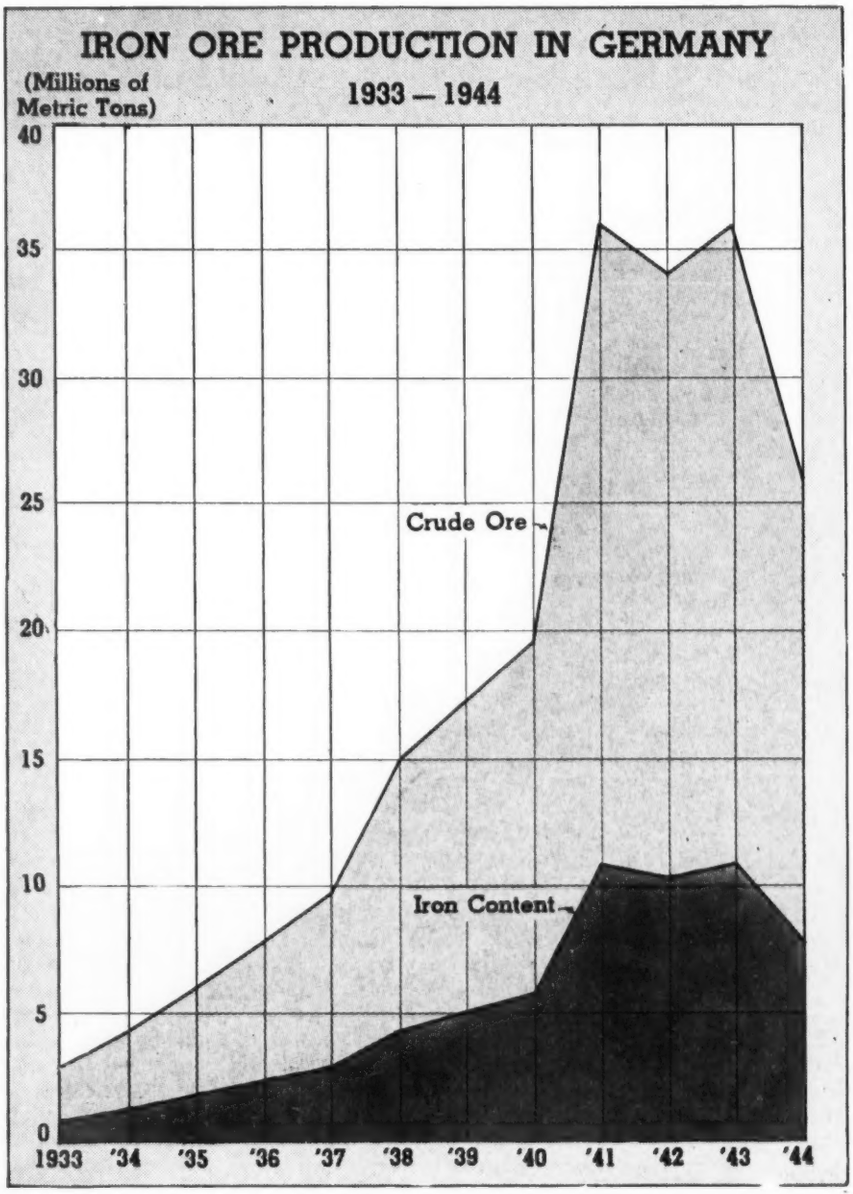
## Europe's Capacity Largely in Germany

The war's end thus found an overwhelming proportion of Europe's alumina and aluminum capacity concentrated in Germany. But the bauxite supplies which fed German plants were largely situated outside the Reich. In 1938 something less than half Germany's bauxite came from France and those Balkan areas that later were to fall under occupation. The remainder flowed from other points in Europe or from outside the Continent. None was mined inside the Reich. But after 1939 Germany had to step up its exploitation of Hungarian and Yugoslavian deposits and expand its imports from Italy. Meanwhile, France also increased its bauxite output to satisfy domestic and British requirements, and this source also became available to the German industry.

Thus the war greatly changed the European aluminum industry in all its stages. Now the decision of the Allied Control Council to prohibit aluminum production in Germany will force a second reorganization of production facilities and bauxite markets throughout the Continent. The greatly enlarged mining capacity in Hungary and Yugoslavia already is producing bauxite for Russian plants, and it is not unlikely that the bulk of this output will be unavailable to Western Europe. France and Italy, with power, bauxite, and industrial know-how, appear to be possible successors to Germany. Although Great Britain and Norway lack bauxite, they undoubtedly will take advantage of an abundance of power to keep aluminum output well above prewar levels.

When equipment of the German aluminum industry finally is catalogued for allocation among the Allies, Russia is expected to demand and receive a substantial part of it. France, Norway, and Great Britain may bid for the rest. There probably will be more than enough to go around. For Germany was by far the largest producer of aluminum on the Continent, and exported less than 10 percent of her output in prewar days. Under the Allied Control Council plan, German imports will be rigidly limited and exchange will be available for very little aluminum. Therefore output on the Continent as a whole is expected to fall short of the wartime peak for a number of years.

Under the de-industrialization




planned by the occupying powers, Germany will be permitted to consume only a fraction of the non-ferrous metals she formerly used. The proposed change from both the prewar and wartime positions looks as follows:

**Consumption (1,000 Metric Tons, Metal Content)**

| | 1938 | 1944 | Postwar |
|---|---|---|---|
| Copper | 448 | 219 | 140 |
| Zinc | 291 | 330 | 135 |
| Lead | 283 | 196 | 120 |
| Tin | 20 | 7.7 | 8 |
| Cobalt | 1.1 | 0.2(a) | (b) |
| Antimony | 2.8 | 2.6(a) | (b) |

(a) 1943. (b) Not announced.

In 1938 Germany imported most of its copper, tin, and antimony ores, as well as about one-half of its lead ore. A substantial proportion of these ore imports came from outside Europe (Table I). Only zinc was supplied largely from within Germany itself.

During the war, Germany of necessity developed new sources for non-ferrous metal ores. Copper came from Yugoslavia, Belgium, Sweden, Norway, and Spain; lead from Yugoslavia, Spain, and Italy; and zinc from Italy, Sweden, and Spain. Only a small amount of tin successfully ran the blockade, coming by submarine from the Orient.

Some of this wartime mining capacity would be considered uneconomical in normal times and will disappear. Other capacity developed in the Balkans already is turning to work on Russian orders—the Mines de Bor, in Yugoslavia, are an example. But despite developments of this character, non-ferrous metal mines in both Western Europe and outside the Continent that formerly served as a source of supply for German smelters and refineries will probably find the demand in Europe as a whole reduced from the level of the late thirties. Germany was the big Continental consumer, and the rise in consumption elsewhere in Europe is not likely to offset the decline in Germany.[1]

Perhaps the most significant aspect of the Control Council plan is the decision to limit German steel capacity to 7,500,000 metric tons of ingots and the yearly output to 5,800,000 tons. The Allied Control Council must specifically approve any production volume in excess of this figure. However, it agrees to review the matter annually.

German (including Austrian) steel output reached 23.3 million metric tons in 1938, a tonnage second only to that of the United States and not far short of the combined production of Britain and the Soviet Union. The German steel industry in the past was characterized by a heavy concentration of facilities near coking coal supplies and a dependence on import from abroad of iron ore and most alloying materials.

In the years before the war more than 70 percent of iron ore needed for German steel came from outside the Reich borders, with Sweden and France the principal sources. This was not a satisfactory situation from the German point of view, and as early as 1936 efforts were made to expand the output of what normally was regarded as uneconomical low-grade domestic ore. The four-year plan set as an immediate goal the production of 9 to 10 million tons of domestic ore, and put its sights on an ultimate output of 31 million tons (with iron content generally ranging from 25 to 30 percent). By 1938 output of such ore had reached 15 million tons.

## Production of Low-Grade Iron Ores Pushed

After Germany became convinced it would be engaged in a long war, it decided to push even more heavily its output of low-grade ore. Its success in this respect is pictured in the graph on this page, which shows that domestic iron-ore production climbed to a maximum of 36 million tons in 1941 (iron content, 10.8 million tons), after which it declined to 26 million tons in 1944.

[1] O. W. Roskill has spelled out the significance of this reduced European consumption for each of the non-ferrous metals in the March 1946 *Engineering and Mining Journal:* "World Survey of Non-Ferrous Metals," p. 76.

Iron ore did not prove a bottleneck to German steel production during the war, although imports varied greatly as the Reich's military fortunes rose and ebbed. Over this period, the source of foreign supplies changed as follows (figures in thousands of metric tons):

| | 1938 | 1943 | 1944 |
|---|---|---|---|
| Sweden | 8,992 | 10,262 | 4,500 |
| France | 5,056 | 7,902 | (a) |
| Belgium and Luxembourg | 1,718 | (a) | (a) |
| Norway | 775 | 292 | (a) |
| Spain | 133 | 456 | (a) |
| Newfoundland | 1,122 | ..... | .... |
| Algeria and Tunis | 886 | ..... | .... |
| Other Countries | 2,118 | 1,329 | 2,040 |
| Totals | 21,928 | 20,241 | 6,540 |

(a) Included in "Other Countries."

Germany, of course, drew on occupied countries for pig iron and steel rolling-mill products, as well as for iron ore. However, it kept both its own imports and output for local consumption to the essential minimum. As a result only a fraction of available capacity in these areas was utilized, a fact illustrated clearly in Table III. At no time did production of steel or pig iron in occupied territories exceed one-fourth of the output turned out in these areas in 1939.

Iron ore mining in Europe will be affected both directly and indirectly by the Control Council's decisions regarding the German economy. First, Germany is likely to import as little iron ore as possible. The necessity to use scarce foreign exchange for foodstuffs will prohibit heavy imports of this character. The German steel industry therefore will be forced to continue to exploit, in so far as is feasible, the low-grade ore deposits within the present borders of the Reich.

Some expansion of the steel industry in Western Europe is to be expected, particularly because German steel facilities will be available for reparations. If coal supplies can be restored to the necessary level, output in Western Europe and in Britain is expected to remain high for some time in response to the immense requirements for reconstruction. However, expansion of the steel industries of Western Europe and Great Britain is not likely to offset the decline in German steel output. For Germany was by far the largest steel consumer on the Continent.

Swedish and French producers of iron ore therefore may expect their output to fall below the record level of the latter thirties and the peak war years. Though Russia may possibly enter the market for high-grade Swedish ore, its desire to achieve self-sufficiency will limit purchases of this character.

The ferro-alloys gave Germany one of its most troublesome supply problems during the war. Almost all of Germany's prewar molybdenum, tungsten, nickel, manganese, antimony, tin, and chrome came from non-European sources—largely the British dominions, China, South Africa, and the Western hemisphere. When these areas were shut off, the Reich fell back upon heavy stockpiles and production available from European territories. Substitute of one alloy for another was frequently necessary. Great ingenuity was demonstrated by German metallurgists in maintaining a high quality of alloy steels in the face of constant changes in the ferro-alloy content.

That Germany was successful in surmounting her ferro-alloy problem is apparent from the picture set forth in Table II. Consumption of nickel, chrome, and manganese did not decline by substantial amounts. Moreover, in a report to Hitler dated Sept. 5, 1944, Speer (head of the German equivalent of WPB) informed his chief that even with the loss of Balkan, Norwegian, Swedish, and Finnish sources, Germany had 36 months' supply of antimony, 20 months' supply of nickel, 9 of molybdenum, 10 of chrome, and 17 of manganese.

The Germans exerted constant pressure to maintain and expand stockpiles of ferro-alloys, particularly when they conquered new sources of supply. Thus the control of Nikopol and Krivoi Rog literally solved the German manganese problem, and domination of Norway assured sufficient nickel supplies from Petsamo. Turkey and the Balkan countries yielded chrome and Spain and Portugal allocated enough tin and tungsten to enable the Reich to limp along.

Many of the wartime supply sources for ferro-alloys developed by the Germans in the Balkans and Finland will now be utilized by Russia. But before the war a number of producers outside of Continental Europe regarded Germany as a principal market. This condition will no longer prevail. Western Europe and Great Britain promise to be the heaviest consumers outside of North

## Table II. German Consumption of Light, Non-Ferrous and Ferro-Alloy Metals

| | (Thousands of metric tons, metal content) | | | |
|---|---|---|---|---|
| | 1938 | 1940 | 1942 | 1944 |
| **Light metals** | | | | |
| Aluminum | 178.8 | 257.8 | 291.3 | 480.0 |
| Magnesium | n.a. | 16.4 | 32.7 | 44.4 |
| **Non-ferrous metals** | | | | |
| Copper | 448.3 | 292.0 | 238.0 | 219.0 |
| Lead | 283.0 | 224.0 | 238.0 | 196.0 |
| Zinc | 291.5 | 330.0 | 449.0 | 330.0 |
| Tin | 20.4 | 8.5 | 8.3 | 7.7 |
| Cobalt | 1.1 | .4 | .5 | n.a. |
| Antimony | 2.8 | 2.2 | 2.4 | n.a. |
| **Ferro-alloy metals** | | | | |
| Nickel | 12.4 | 11.6 | 8.0 | 9.5 |
| Molybdenum | n.a. | 2.2 | 1.8 | 0.7 |
| Chrome | 27.4 | 35.3 | 38.4 | 42.4 |
| Manganese Ore | 135.9 | 130.2 | 124.1 | n.a. |
| Tungsten | 4.3 | 3.7 | 3.0 | 1.5 |
| Vanadium | 0.7 | 0.8 | 1.8 | n.a. |
| Titanium | 4.9 | 5.9 | 8.5 | n.a. |

n.a. Not Available

Source: "The Effect of the Strategic Bombing on the German War Economy," pp. 263-4. Taken from official German documents.

America, once supplies and exchange become available.

Allied bombing inflicted little damage on German mining, smelting and refining equipment. Early in the war a few small-scale attacks were directed against alumina and aluminum plants, but destruction was small and the industry later was dropped as an objective. During 1944 a few attacks were made on individual copper, lead, zinc, tin, nickel, and cadmium plants. Several zinc works were hard hit (Gresche, Madgeburg and Gresche, Oberspr.), but output neither in this industry nor in others suffered appreciably, as shown[2] by the bar chart at the beginning of this article.

Practically no direct bomb damage was inflicted on mine installations of the metal industry. However, heavy attacks on the Ruhr and the Rhineland crippled the outside operational facilities of many coal mines.[3]

The steel industry was a principal objective of a number of Allied raids. But the industry was not easily hurt, and neither damage to facilities nor loss of output was in any sense a critical blow to the German war effort. Producers claimed that if no air raids had occurred, output in 1944 would have been 5.4 million metric tons larger than the 26.9 million tons actually turned out. In the late months of 1944 raids on the Ruhr finally did cut steel production in the Northwest district from 1.2 million tons in August to 0.3 million tons in December.

The decline in steel output was the result principally of damage to transport facilities in the plants and the general area, to auxiliary facilities like gas and power lines, and to other like installations. Very little damage was inflicted on steel-producing equipment itself.

Most mining, smelting, and refining equipment in Germany has escaped undamaged from the war. Under the Potsdam agreement and the current plan of the Control Council much of this equipment will be tagged for reparations.

The Control Council is now undertaking a complete inventory of all German industrial facilities. After this is completed, reparations claims will be entered against that not required for German production. Some time is likely to elapse, however, before agreement is finally reached as to what equipment actually will be allocated to various countries. The Potsdam agreement provided that Russia should receive reparations from equipment available from within its zone. But, in addition, Russia is to obtain from the Western Zones one-fourth of such industrial equipment as "is unnecessary for the German peace economy." This vague formula for determining Russian reparations that are to be taken from the Western ones has created difficulty. For Russia is known to have removed certain equipment from its own zone in the early days of occupation as "war booty." Apparently this "war booty" is not to be included as part of the total stock of German equipment.

Table III. Production of Steel Rolling Mill Products in Germany and Occupied Territories

| | (In Thousands of Metric Tons) Greater Germany | Occupied (a) Countries | Grand Total |
|---|---|---|---|
| 1941 | 19,660 | 2,881 | 22,541 |
| 1942 | 19,179 | 2,580 | 21,759 |
| 1943 | 21,318 | 2,892 | 24,210 |
| 1944 | 17,173 | 1,979 | 19,152 |

(a) Includes Poland, Meurthe and Moselle, Belgium, Northern France and the Netherlands. In first half of 1944 also includes Northern Italy and Central France.

## Most Equipment Located In Western Zones

A large proportion of the mining and metal-manufacturing equipment left in Germany is in the Western Zones of occupation. Almost all the hard coal, two-thirds of the iron ore, and most lead and zinc mines are within these areas. Because of this preponderance of raw materials, metal refining, smelting, and processing industries are also centered to a considerable extent in areas not occupied by the Russians, the Ruhr area of the Rhineland being outstanding in this respect. Thus the Western Zones include about nine-tenths of total iron and steel capacity, two-thirds of the non-ferrous smelter and refinery facilities, and almost all the foundries within the present borders of Germany.

The Potsdam proclamation specifically singled out the metallurgical industries, in company with chemical and machine manufacturing, as the primary source of reparations for Russia in the Western Zones. The U.S.S.R., therefore, may be expected to request extensive German equipment from the Western Zones for expansion of its own capacity in such items as alumina, aluminum, iron and steel, and non-ferrous metal smelting and refining.

The Western Allies also will seek equipment from their own zones. France, Britain, and other Western European countries may not wish to expand their total capacity in such industries as steel and non-ferrous metal refining. But many of the German facilities are of superior quality and will be requested to replace obsolete equipment.

Whichever direction German equipment moves, whether to Russia or to the West, its departure from Germany will signify a vast change in the mineral economy of Europe and the world. For peactime Germany was the industrial heart of Europe, a position it held because it possessed unusual resources and technical skills.

As the plan for restricting German output is presently constituted, Germany's capacity to make war will be killed. Nevertheless, it is fair to weigh the costs of the program in determining its merits. For the mining and metal industries the cost will undoubtedly be a lower consumption and output of minerals in Europe than existed in normal peacetime years. It is true that Russian output of metals will be expanded by transfer of German equipment. But all signs point to Russia remaining a closed economy, and other than in the East, Europe probably will not share in Russia's advance. The big question, and it is one on which opinions differ, is whether the rest of Europe can increase its standard of living while lower standards are forced on Germany.

[2]Of much greater significance to the metal industry were the indirect effects of bomb damage to transport and other utilities. In some instances coal did not reach plants; in others alumina and bauxite shipments were greatly reduced. Bauxite mining in Croatia was stopped in early 1944 as a result of aerial interference with coastwise shipping on the Adriatic, which led to excessive accumulation of ore at the mines ("Effects of Strategic Bombing on the German War Economy," p. 113).

[3]Here again the heaviest loss of output was the result of damage to transport and other utilities, which made it impossible to move coal or to operate the mines.

# Qualities of the Foreman Men Like to Work With

**PHILIP D. PEARSON,** Superintendent, Sherwood Mine, Inland Steel Co., Iron River, Mich.

DURING THE WAR YEARS, foremen have had to fill a difficult position. They have been in the middle, where they have had to maintain high production standards to satisfy the enthusiastic schedules of their supervisors, but where they have had to do it with an ever-changing and diminishing group of employees. More has been demanded of foremen than ever before, just as it has been demanded of all members of supervisory staffs. A careful examination of the qualities most desirable in foremen may help them meet the demands of the future.

Some time ago our vice president wrote to his general superintendents and explained to them that he expected to make a talk on the subject of "The qualities that make up a good foreman," and requested their comments on the subject. The general superintendent of the iron mines passed on this request to his superintendents and asked for their reactions. As I was one of this latter group, I prepared my small contribution. Some time later, after the vice president had collected twelve or fifteen letters from his various supervisors, he wrote the following comment; "I am taking . . . with me . . . the letters which I have now collected. After reading them I have come to the conclusion that if there is a foreman who has all of the qualities listed, he will at once sprout wings and fly away." I realize that my letter was one of the fifteen, and this realization should tend to keep the discussion on practical grounds.

The chief requisites to keep a supervisor's position successful, enjoyable, and profitable are good foremen. As a superintendent, I want my foremen to develop their ability to think a situation through and to act after careful deliberation. I want them to have confidence in this ability, so that in the absence of superiors and when faced with an important decision they will have the courage and ability to handle it. I want them to develop their powers of concentration to determine when decisions should be referred to higher authority and when action can be taken first and then the information passed along. In general any clear-cut decision, arrived at by careful thought and directly executed in the interest of the welfare of the organization, will meet with the approval of the superintendent.

Supervisors want all basic and essential characteristics well developed in their foremen. Some of these are: trustworthiness, cleanliness, neatness, loyalty, impartiality, tolerance, leadership, and straightforwardness; in other words, all the qualities that the men who work under the foremen expect and are entitled to in the men who lead them.

## Leaders Must Be Fair

Impartial decisions can do more to keep harmony in a group of employees than any favoritism can do. Each foreman can keep his crew satisfied and working smoothly if he demonstrates that his decisions and assignments are fair and impartial. The men want and expect their foreman to be above average intelligence and ability, and they expect him to lead and direct operations in a forthright manner. The working man today expects and demands that his foreman pursue a harmonious and friendly manner rather than a dictatorial policy.

As it has been conceded that the foreman's position today is a delicate one, he can do much to promote harmony or do much by a few idle words to create grievances. Most superintendents at some time have faced grievances brought about by foremen who, to demonstrate the extent of their authority, have told men what they, as foremen, can do if they wish. There is no need for these statements, and the only answer to such a grievance is to say that until the situation arises where the foreman has to make such decisions, there is no cause for dissatisfaction.

In this instance, the foreman has gone out of his way to invite trouble. He is expected to think about the consequences before he talks, and he must realize that sometimes undue importance may be attached to his casual statements.

What we want in our foremen can often be best instilled from the policies and practices of the superintendent himself. A superintendent friend of mine for whom I have a lot of respect, when discussing this general subject, once said that we as superintendents must be conscious of the difficulties foreman may have in not becoming better foremen. A foreman may have all the qualities that both men and management want but be throttled by his supervisor. My friend went on to say that all the good work performed by a foreman can be quickly undone by his having to carry out an unfair or a thoughtless decision made by his superior. The foremen reflect the policies of their supervisors and cannot be expected to exercise judgment superior to that of their supervisors.

In conclusion, wage earners and superintendents mostly want the same qualities in their foremen, although superintendents require a few additional abilities. Most of all, a superintendent wants his foremen to develop the ability to make intelligent decisions after careful deliberation. He wants trustworthiness, loyalty, impartiality, leadership, upright community life, straightforward habits, and a cool conception on the part of the foreman of his own important position in the organization.

The reactions set forth here are from personal experiences in iron mining and should be evaluated as such. They are justified because of the timeliness of this subject and because of the importance of the relationship between the foreman and the wage earner, and between the foreman and the superintendent. The winning combination can best be attained through the foreman, who, in his in-between position, deals directly with the employee and directly with the superintendent, and who is conscious of what is most wanted by each.

# Plant Power Costs Reduced With Shunt Capacitors

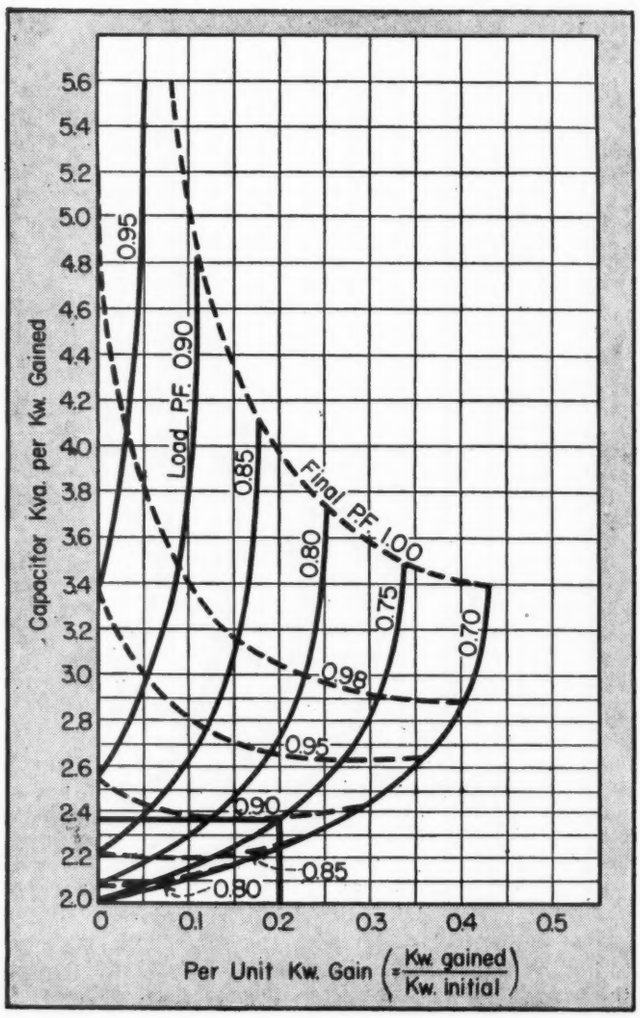
**W. H. CUTTINO,** Switchgear and Control Engineering Department, Westinghouse Electric Corporation, East Pittsburgh, Pa.

MAGNETIZING CURRENT is required in all industrial plants to excite the field of motors, transformers, and other equipment. This current, although necessary, does not produce useful energy and is out of phase with the power current, which produces useful work. The adding of capacitors to supply this magnetizing current eliminates the handling of this extra current over the power-supply system and reduces the generator and distribution capacity required for handling the load. Thus the cost of electric energy can usually be reduced by using capacitors to supply the lagging kilovars.

Just as utility companies install capacitors on their distribution circuits to release system capacity, reduce losses, and improve voltage regulation, mines, mills, and smelters can make similar improvements on plant circuits.

Magnetizing current in a circuit affects the handling of electric power in two ways: first, it increases the energy loss in the circuits due to the higher current caused by the low power factor which is reflected all the way back to the generating station; and, second, the magnetizing current, if relatively large compared to the in-phase or power current, depresses the voltage at the machine terminals. The depressing of voltage below normal on the motor terminals results in increased current and decreased torque or reduced efficiency.

The term "power factor" is a method of expressing the proportion of in-phase or power current to the total current made up of the combination of power and magnetizing current. Most utilities have adopted



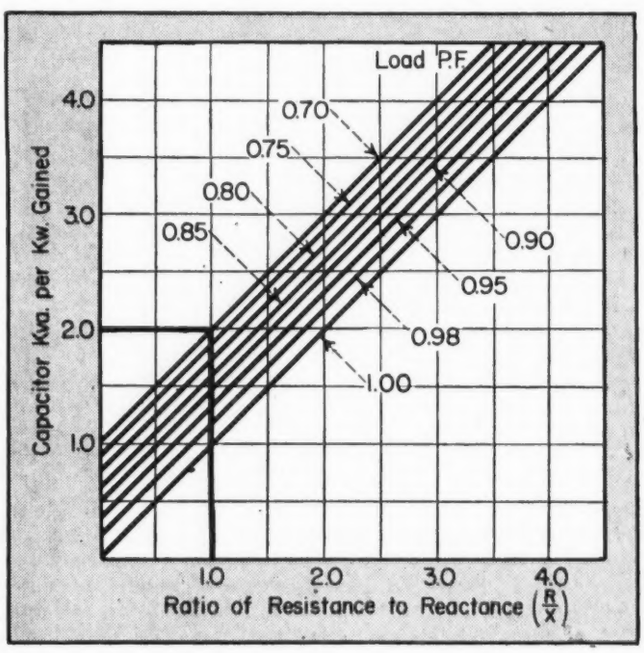




**FIG. 1. THESE CURVES** (shown at left) indicate how many kilowatts of load can be added, by adding capacitors, without increasing line currents. For instance, if the power factor in a circuit is 75 percent, a 20 percent gain in kilowatts can be made by adding 2.38 kilovars of capacitors per kilowatt gained. Dotted lines show power factors that will obtain after capacitors have been installed.

**FIG. 2. CURVES ABOVE AID** in estimating the kilowatts gained per capacitor kilovar that can be expected for different power factors and for circuits with different ratios of resistance to reactance. For example, if the ratio of line resistance to reactance is one for a circuit between a capacitor and substation, and the original power factor is 70 percent, an extra kilowatt of load can be added to the circuit without increasing the voltage drop if two kilovars of capacitors are added.

CAPACITORS SUCH AS THIS at underground operations of the Louisville Cement Co., New York, corrected the power factor from 57 percent to 95 percent. The cost of capacitors was repaid in about three years, and the current-carrying capacity of the line was increased some 15 percent.

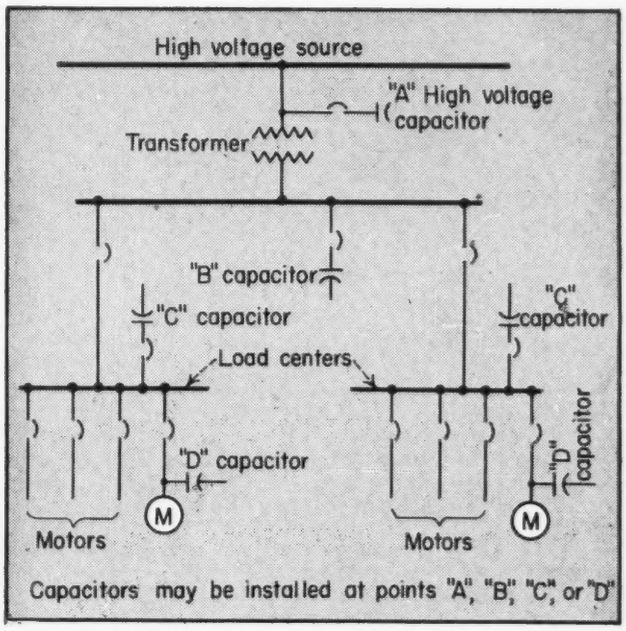



FIG. 3. GREATEST BENEFITS OCCUR when capacitors are connected near the load requiring magnetizing current such as the motor at point "D." However, circumstances described in the text may warrant installations at points "A," "B," "C," or "D."

the practice of taking power factor into account in the rates of electric service. These usually appear in the rate schedule in the form of a bonus for high power factor, a penalty for low power factor, or a kva. demand charge. Substantial reductions in power bills have been affected with capacitors, which generally have saved the cost of the capacitors within the first two years.

To illustrate the savings that have been obtained by adding capacitors, one manufacturing company in Pennsylvania reduced its monthly power bill $453 by installing a 570-kva. capacitor. This plant demand was approximately 2,250 kva. at 80 percent power factor with monthly consumption of 567,000 kw. The 570-kva., 3-phase, 60-cycle, 2,400-v. capacitor cost $5,581, but with savings of $453 per month the capacitor pays for itself in less than thirteen months. The capacitor is a static device with no moving parts, and once installed it requires little attention or maintenance.

Capacitors can also be used to release capacity. If the plant power factor is low and the current-carrying capacity of the plant feeders limits adding load, it will be found that the kilowatt-carrying current can be increased by adding capacitors to supply the lagging kilovars or magnetizing current. For example, if there are eight motors of equal horsepower on an electrical circuit, with an average power factor of 76 percent, and if capacitors are installed to improve the power factor to 95 percent, two additional motors of the same size can be added with no increase in line current or line losses.

## Units Permit Greater Load

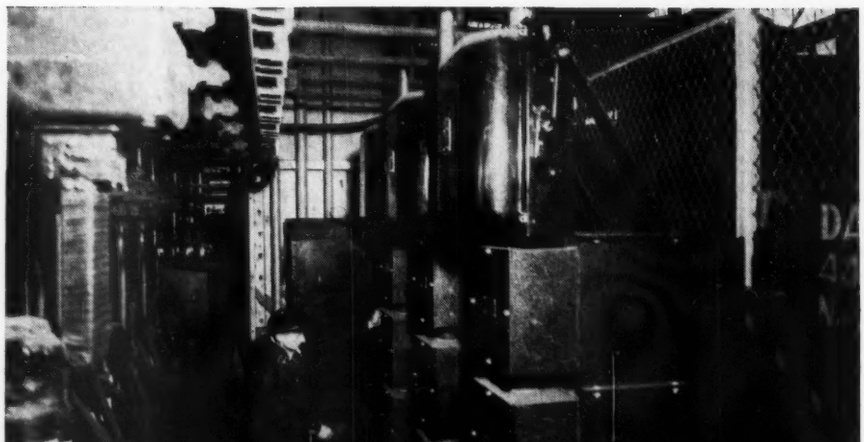
The curves in Fig. 1 can be used to determine conveniently how many kilowatts of load can be added by adding capacitors without increasing the line current or line losses. For example, assume it is desirable to increase the kilowatt load 20 percent on a circuit without increasing the circuit current. Referring to Fig. 1, it will be obvious that a 20 percent gain cannot be accomplished if the load power factor is 85 percent. If the power factor is 75 percent, a 20 percent gain in kilowatts can be made by adding 2.38 kilovars of capacitors per kilowatt gained. If the installed cost of capacitors per kilovar is about $20 for 230-v. capacitors, and about half that value for 460- or 575-v. capacitors, the cost per kilowatt gained would be approximately $23.80 if the circuit voltage is 460 or 575 v.

The effect of lead on the voltage of a circuit depends on the reactance and resistance of the circuit and the size and power factor of the load. For practical purposes the voltage drop can be determined from the kilowatt load or power current flowing through the resistance of the circuit plus the out-of-phase component or magnetizing current flowing through the reactance of the circuit. The voltage rise produced by the capacitor is the product of the circuit reactance ohms and the capacitor current.

$$\text{Percent voltage rise} = \frac{\text{ckvar} \times \text{circuit reactance in ohms}}{10 \times (\text{line kilovolts})^2}$$

The amount of plant capacity that can be released by adding shunt capacitors without increasing voltage drop can be readily determined from the curves in Fig. 2. These curves were plotted to permit the estimating of cost per kilowatt or kilowatt gained per capacitor kilovar that can be expected for different load power factors and for circuits with different ratios of resistance to reactance.

Referring to Fig. 2, and assuming a ratio of line resistance to reactance



**THIS 3,000-KVA MULTIPLE UNIT capacitor installation saves $485 annually in demand charges. Multiple-unit installations may be adjusted to meet changing conditions.**

of one for the circuit between the capacitor and the substation and an original power factor of 70 percent, it is shown that an extra kilowatt of load can be added to the circuit without increasing the voltage drop if two kilovars of capacitors are added. If the installed cost of capacitors per kilovar is $10, the cost per kilowatt of load gained would be $20. This is usually much more economical than rewiring the plant to obtain released capacity.

## Why Correct Power Factor

It should be kept in mind that the energy loss in any conductor varies as the square of the current flowing. If we assume a load power factor of 70 percent with a power current of 70 amp, the total current is 100 amp. The energy loss is increased not by the ratio of 700 and 100 but by the ratio of 100 squared and 70 squared. The loss at 70 percent power factor is therefore more than double what it would be at unity power factor.

Capacitors may be applied at different points on an industrial plant distribution system as illustrated in Fig. 3. The greatest benefits from the capacitors occur when they are connected near the load requiring the magnetizing current, such as motor terminals designated "D." This reduces the current and losses along the supply feeders and also improves the voltage regulation.

If the motors are relatively small or if only a certain portion of the total motors are expected to be connected at one time, it is usually more economical to place the capacitors at the load centers designated "C" in Fig. 3.

In some instances the plant loading is expected to vary widely and shift from one load center to another, and in such circumstances it is usually more economical to install the capacitors at the low-voltage bus designated "B." Unless there is poor regulation or excessive heating in the transformer caused by high current, it usually make little difference whether point "A" or "B" is chosen. If the secondary voltage is 230 v., the higher voltage installation at "A" is usually more economical.

It should be remembered that the greatest benefits from the capacitor occur when they are connected near the load. However, if the voltage at the plant bus and load centers is relatively high during full-load operating conditions because of the power system operating near the upper limit, and it is desirable to have capacitors connected to take advantage of the lower power billing, it is usually preferable to locate the capacitors at point "A" to keep the voltage rise produced by the capacitor to a minimum. A study of the existing voltage conditions and the determination of the voltage rise produced by the capacitor is the proper procedure in determining the best location for the capacitor.

When considering the installation of capacitors, it is usually desirable to determine the voltage rise during light load periods, and if found to be higher than can be tolerated, consideration should be given to their connection directly to the motor terminals to be switched "off" and "on" with the motor and thus eliminate the high voltage during light load periods. If the capacitor cannot be placed or connected to avoid excessive light load voltages, suitable means for automatically switching the capacitor off during light load periods should be considered.

Capacitors can be automatically switched to prevent overvoltage, improve voltage regulation, reduce line current and losses, to keep the demand low in proportion to the kilowatt loading, avoid objectionable harmonics at light load, or keep the power factor within given limits to obtain minimum cost of power purchased under certain rate schedules.

The question of whether or not capacitors should be automatically switched can be answered after proper consideration has been given to the size of the capacitor, the extent to which the kilovar and kilowatt load varies over a typical load period, the variation of voltage with load, and the benefits of improved performance and reduced costs. When more and more capacitors are added to a system with widely varying loads, a situation is reached where their effect becomes objectionable during certain operating conditions. Automatic switching, therefore, makes possible obtaining the benefits of additional capacitor correction without the objectionable aspects.

## Automatic Switching

If it is found that the capacitors should be automatically switched, the following steps are recommended in selecting the size and number of switching steps:

1. Determine the maximum capacitor kilovars permitted during light load without exceeding the upper voltage limit, to maintain desired power factor or to keep the reactive kilovars within desired limits.
2. Determine the maximum capacitor kilovars that can be switched at one time without exceeding the permissible voltage limits, kilovar demand, or change in power factor.
3. The difference between the total capacitor kilovars installed and the capacitor kilovars allowed during light load determines the total capacitor kilovars to be switched.
4. The minimum number of switching steps is the ratio of the total capacitor kilovars to be switched to the maximum capacitor kilovars that can be switched at one time without exceeding permissible limits.

# New Yardstick for Gaging A Drill's Economic Life

**A. F. HORLE,** Cia. Minera Asarco, Parral, Chih., Mexico

**How this operator determines where to replace worn-out machines, so as to hold operating costs down.**

THE POSSIBILITY OF CUTTING DRILLING COSTS by discarding rock drills as soon as they are worn out is often neglected. Though the operator realizes that an old machine uses more air and more new parts per foot drilled than a new one does, he is naturally slow to put money into new equipment without knowing how much he will save by doing it. Thinking that he is playing safe, he often continues to use a rock drill long beyond its economic life.

To provide a yardstick for measuring the economic life of a rock drill, a study was made of the cost of drill repairs and of compressed air at the Asarco Mining Co.'s unit at Parral, in Chihuahua, Mexico. The formula derived applies to any rock drill. The variables and the unknowns, however, will vary with the different makes and types of machines.

The conclusion drawn from the results of this study is that a rock drill should be discarded when the total average cost per foot drilled over the total life of the machine has reached a minimum. This total cost is found by adding the original cost of the drill, the total cost of air, and the total cost of repairs, and dividing the sum of the three items by the total footage drilled. This is expressed mathematically in the following formula:

$$K = \frac{C}{50F} + \left(A + U + \frac{F-1}{2}(a+u)\right)$$

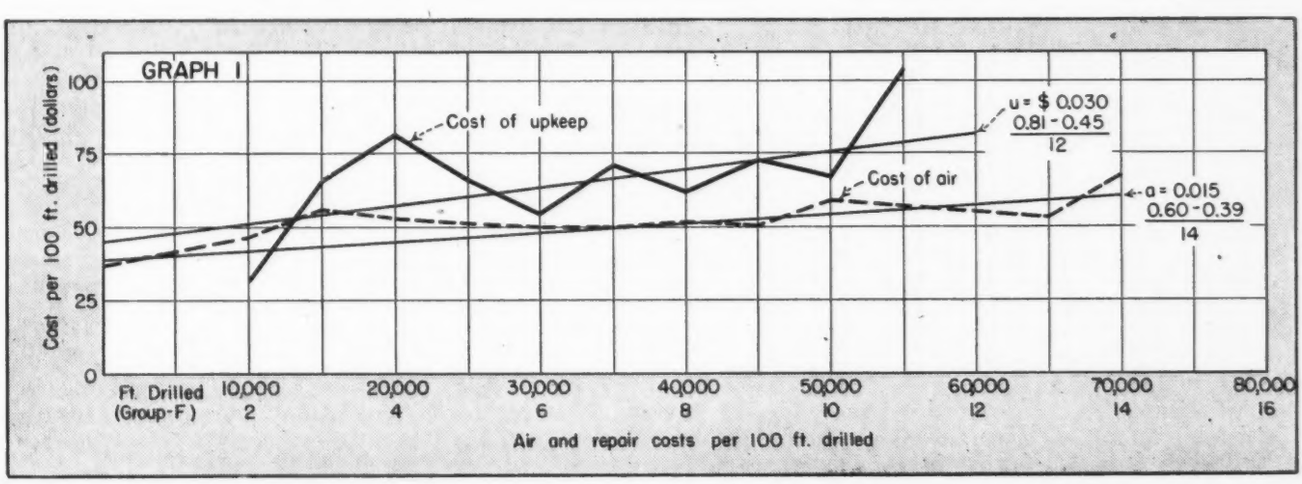
where $K$ = total average cost, over the life of the drill, per 100 ft. drilled.
$F$ = number of 5,000-ft. units drilled.
$C$ = original cost of the drill.
$A$ = cost of air per 100 ft. drilled with a new drill.
$U$ = cost of repairs per 100 ft. drilled (new drill).
$a$ = increase in cost of air per 100 ft. drilled for each additional 5,000 ft.-unit drilled.
$u$ = increase in cost of repairs per 100 ft. drilled for each additional 5,000-ft. unit drilled.

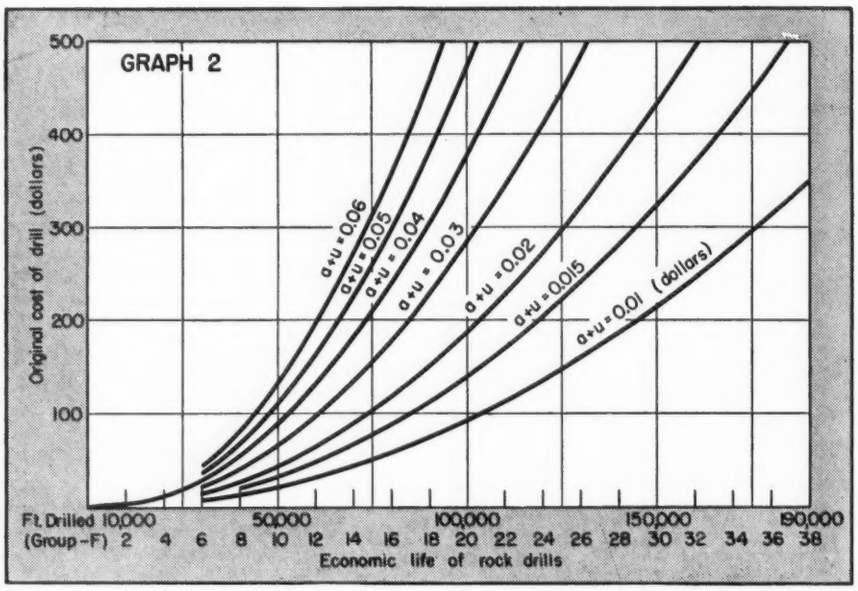
The conclusion stated is supported by the following assumption. Assume that the minimum average cost per foot drilled is reached in 36 months' operation and that there are 36 drills in operation. By replacing one machine a month the total average cost is kept at the minimum. If more or fewer drills are bought per month, the total average cost per foot drilled will increase and the total monthly cost of drilling will increase as well.

By plotting the cost of air consumed per 100 ft. drilled in the various "footage drilled classes," points were obtained from which to draw a curve indicating the cost of air for a new machine as well as the increment of cost as the machine grows older. Similarly, the cost of repairs was plotted using data obtained from various "footage drilled classes," and the corresponding unknowns were derived from this curve. These curves are shown in graph 1.

As the basic cost of air and repairs for any one type and make of machine is a constant, these figures do not enter into the calculation of the economic life of a machine, the only figures affecting this life being the original cost and the increment, or increase, in cost of air and repairs per 100 ft. drilled for each additional unit drilled.

When the decreasing negative increment of the original cost of the machine per 100 ft. drilled for each drilling unit equals the increasing increment of cost of air and repairs for the corresponding drilling unit, the total average cost over the life






of the drill per 100 ft. drilled, or $K$, will be a minimum. This is expressed by the following equation:

$$\frac{C}{50\,(F-1)} - \frac{C}{50F} =$$

$$\left(A + U + \frac{F-1}{2}\,(a+u)\right) \text{ minus}$$

$$\left(A + U + \frac{(F-1)-1}{2}\,(a+u)\right)$$

Eliminating the basic cost of air and repairs per 100 ft. drilled, $(A + U)$, the equation becomes

$$\frac{C}{50\,(F-1)} - \frac{C}{50F} =$$

$$a + u\left(\frac{F-1}{2} - \frac{F-1}{2} + \frac{1}{2}\right)$$

$$\text{or } F^2 - F = \frac{C}{25\,(a+u)}$$

from which are derived the curves in graph 2, which indicate the economic life of any rock drill.

Using the variables obtained from tests on 38 drifters, we arrive at an economic life of 96,000 ft. drilled from the curves in graph 2. The various factors, determined from tests and the curves in graph 1, are

$C =$ 391 dollars
$A =$ 0.39 dollars
$U =$ 0.45 dollars
$a =$ 0.015 dollars
$u =$ 0.030 dollars
$F =$ 19

Using the formula given at the start

$$K = \frac{C}{50F} + \left(A + U + \frac{F-1}{2}\,(a+u)\right)$$

$$K = \frac{391}{50 \times 19} + \left(0.39 + 0.45 + \frac{18}{2} \times 0.045\right)$$

$$K = \frac{391}{950} + 0.84 + 0.405$$

$$K = 0.411 + 0.84 + 0.405$$

$$K = 1.656 \text{ dollars}$$

If we determine the cost per 100 ft. drilled for a total footage drilled of 90,000 ft., we find that it is 1.657 dollars, and for 100,000 ft. it is 1.659, which shows that the formula used checks with the results obtained by using the curves given. Therefore, the average drifter tested should be discarded after it has drilled 96,000 ft.

# How a Sudden Demand for Optical Calcite Was Met

**CLARENCE R. KING,** Consulting Mining Engineer, Box 210, Santa Ana, Calif.

**When new wartime types of fire-control equipment called for tons, instead of pounds, of this comparatively rare mineral, a hitherto overlooked supply in the Sierra Madres, in Sonora, was tapped.**

PRIOR TO THE WAR the principal use for optical calcite was in the manufacture of Nicol prisms and optical elements of other instruments utilizing the high double-refraction of calcite for the polarization of light. To date, no satisfactory substitute for the natural Iceland spar crystal has been found.

Calcite veins are common in many parts of the world, but few localities have produced the rare Iceland spar variety, and these localities only in limited amounts. The principal sources of optical calcite prior to the war were Iceland (hence the name Iceland spar), New Mexico, Montana, Oregon, California, parts of South America, Africa, Italy, Spain, and Russia. Because of the pockety nature of the deposits, no steady production has been attained, and no profitable organized mining operations have existed for any length of time. In this respect, the production of optical calcite may be compared to the production of large diamonds; accident and luck have heretofore accounted for small amounts at irregular intervals from many places.

Before the war, the average world consumption of Iceland spar for optical purposes was approximately 1,500 to 2,000 lb. per year. This consumption was conditioned by production rather than by demand, which condition was reflected in the high price paid for the material (from $20 to more than $100 per pound, depending on crystal size and the state of the market).

Optical calcite was commercially unknown in Mexico prior to 1937. Doubtless many mining engineers and others passing through the great volcanic complex of the Sierra Madre in the search for metal mines had noticed transparent Iceland spar weathering out of the thousands of calcite veins in this region. The Indian tribes inhabiting the Sierra have long used cleavage fragments, smoked on one side, for mirrors. No thought, however, was given to the possibility of the commercial occurrence of optical calcite, or at least nothing was done about it, until in 1937 Dr. E. M. Stanton, Jr., began to prospect the northern part of the west slope of the Sierra Madre, and produced a little Iceland spar from a place near Cumpas, in Sonora.

About the same time I was investigating the calcite veins near the Monterde gold mine, in the Creel region of Chihuahua, this as a hobby. The coming of the war, with its attendant problems for me as manager of a gold mine in Mexico, stopped this work until the middle of 1943, when the need of optical calcite for certain types of fire-control equipment precipitated a critical demand for tons instead of pounds of the crystal. For this application first-grade optical calcite was not necessary; some color and inclusions could be tolerated; as no great degree of magnification was involved in the instruments, and a piece of calcite transparent to the unaided eye, free from twinning (except basal) or fracturing, and of the proper dimensions, was suitable.

Before attention was turned to Mexico, a survey of the other possible sources of the mineral, both in the United States and in other countries, was made, which resulted in only a negligible production at very high cost. These activities were necessarily secret, and I had no intimation of the need for this material until the middle of 1943.

## War Agencies Investigate

At that time a preliminary investigation of the productive possibilities of northern Mexico was undertaken by the U. S. Geological Survey, in cooperation with the Mexican Government, and by Dr. Stanton and myself, after consultation with the Bureau of Ordnance of the U. S. Navy. It was evident that immediate production could be attained if certain essential steps were taken, and the first sub-optical and optical calcite for the war program was shipped in September, 1943.

I was called to Washington the following January to discuss the possibilities of producing quickly a major quantity of sub-optical calcite from this region of northern Mexico. The problem was not one of limitation of the existing quantity. Thousands of calcite veins are known to me as a result of many mine-examination trips through all parts of the region over many years. If 1 percent of these veins produced a little sub-optical calcite, more than enough would be forthcoming. Instead, the problem was one of organization, with the time element the most important consideration; how to prospect quickly a great many calcite veins widely scattered through one of the most rugged mountain masses in the world; how to get production quickly from veins showing promise, where the only means of transportation and communication is the long-suffering mule or Indian runners; and how to avoid delays due to human inertia and political interference.

## Essential Factors

Because of the peculiar conditions inherent in searching for and producing quickly a mineral heretofore unknown in Mexico, and found in scattered pockets over wide areas in terrain difficult of access, it was believed that the following factors were essential to quick exploration and production:

1. Establishment of a price per kilogram or per pound high enough to stimulate prospecting of an intensive scale by local inhabitants, once they knew what to look for.

2. Dissemination of information as to price and other factors to prospectors and producers, to eliminate undesirable speculative elements.

3. Intensive instruction of local inhabitants by word of mouth on what to look for and where to look for it. This point was important; the first deposits showing promise in each district were subsidized until profitable operation was assured, to get production at strategic places. This immediately stimulated prospecting at each point, and production would "snowball."

I personally visited more than 200 possible producing points in two months of steady travel, spreading information, advice, and distributing specimens among the people. With one or two points opened and producing a nice profit for the owners in each district, the prospecting problem was solved; every inhabitant of the district immediately became a prospector, and because his incentive was personal profit, he was more efficient than salaried prospectors.

4. Payment for material accepted, on the spot was in cash. The average producer could not and would not wait several months to find out what he would get for any given lot of calcite. This was one of the most difficult problems to solve. Few men capable of field-grading optical calcite were available.

Cooperation between factory and field was not satisfactory, nor could it be made so, because of the time lag between acceptance in the field and arrival at the factory. This threw a heavy responsibility on the field men, as the price was based on field acceptance on the assumption that field-graded material would yield over 60 percent usable material at the factory.

5. It was essential to establish one, and one only, channel of market and system of payment. It is a natural trait, not confined to the Mexican people, to hold something of value if there is a chance of getting a higher price. This could not be tolerated, and it was essential that there should be no intervention by private or governmental agencies except with a complete understanding of the exact program, at least in its early stages.

## Results Successful

With the marketing channeled through one agency and with a fixed price, and with information disseminated freely by all private and governmental agencies interested, an immediate production of optical and sub-optical calcite was attained, with little speculative interference.

By May 1944 sufficient calcite was at the factory to take care of urgent needs, and by July 1 a substantial reserve had accumulated, a large part of which was produced in northern Mexico. Close cooperation between all factors involved was maintained throughout the period of urgent need and intensive production. That November, the redesign of the fire-control equipment, and the invention of a substitute for the calcite used in it, eliminated the need for sub-optical calcite, and the program was suspended.

A theory as to the origin of optical calcite developed from observation of the circumstances attending many occurrences will be discussed in an early issue. Some practical rules will likewise be given for prospecting for the mineral, based on wartime experience, and the procedure for extracting the crystals and preparing them for the market will be described.

# Untested Colombian Basin May Hold Large Gold Placer

**JOHN F. TROUTMAN,** Cali, Colombia

UNTIL RECENTLY, the gold alluvials of the upper Saldaña River, in the State of Tolima, in Colombia, have been so inaccessible that no great interest for large-scale dredging operations has ever been shown in them. Late in 1943, the Government of Colombia completed an automobile highway from the station of Castilla, on the Neiva Railroad, to the small town of Ataco, which is situated near the lower end of the richer alluvials of the upper Saldaña River.

Since completion of this highway into Ataco, much interest has been taken in the region, with the result that all the dredgeable ground on the upper Saldaña River has been titled in accordance with the existing mining code. It would seem that the general physical conditions for successful gold dredging warrant examination of this area to determine its gold content.

The main stream of the Saldaña River rises at the foot of the "Nevada de Huila" peak, in the extreme southwest corner of the State of Tolima, and through its many tributaries rising in the Central Cordillera of the Andes, the Saldaña drains more than a third of the State of Tolima. The Central Cordillera through this part of Colombia is one of the highly mineralized sections of the country and contains numerous small lode mines, the combined gold output of which is considerable. In addition to the general mineralization of the Central Cordillera, the upper reaches of the eastern slope contain vast areas of older gold-bearing alluvials which are known to have quite good values in many places. The Saldaña River and its tributaries have cut through these older alluvials with a tremendous movement of gravel which has unquestionably enriched the original deposits brought down from the generally mineralized zone of the Cordillera. Old workings, dating from the time of the Spaniards up to the present, are found throughout the whole region and bear mute witness to the existence of gold.

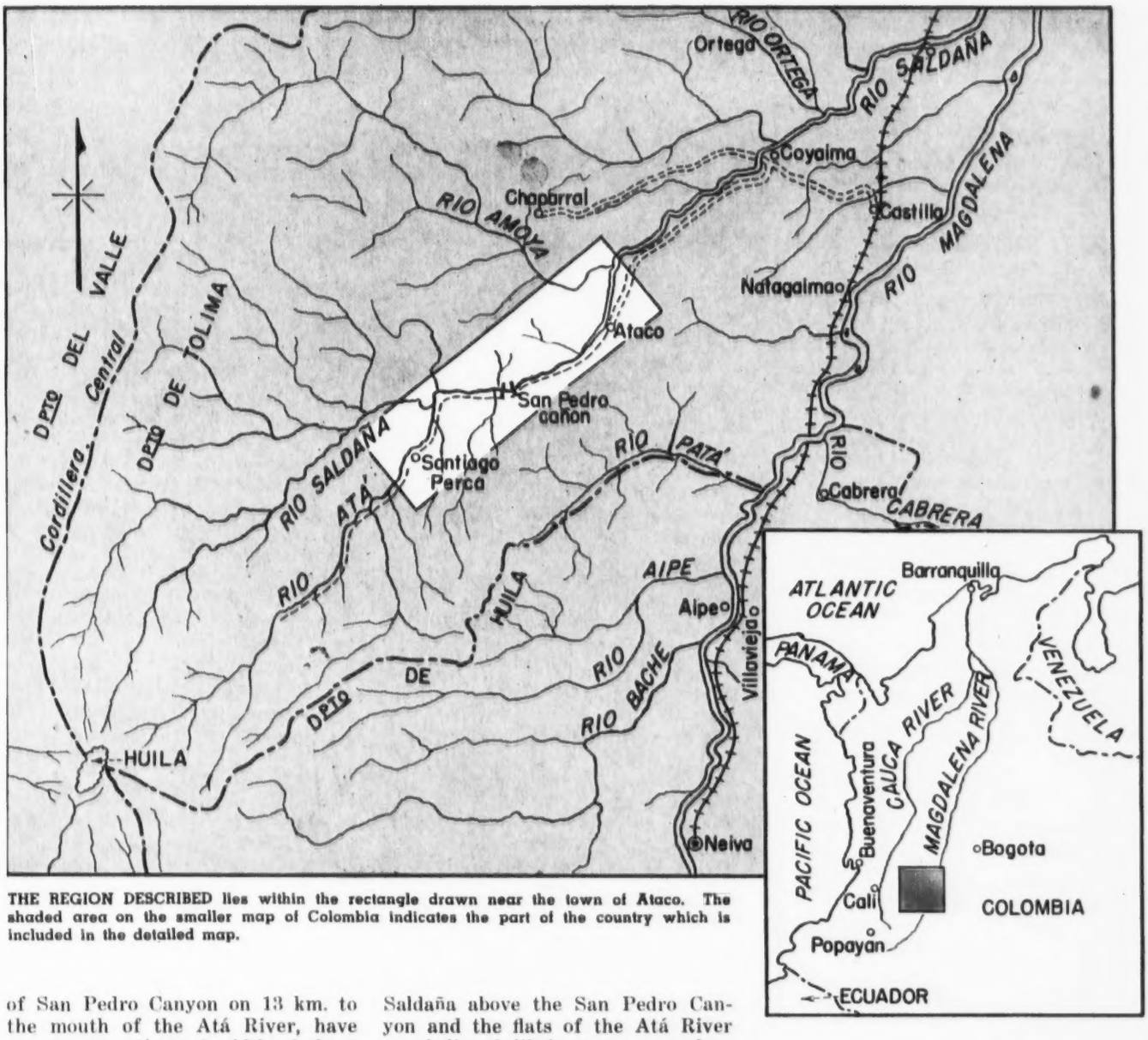
## Valley Is Dredgeable

The Atá River also rises near the foot of the "Nevada de Huila" and has cut through the same older alluvials as the Saldaña River, which it joins some 40 km. above the town of Ataco. The Atá basin is known to carry gold values, and is dredgeable for 12 km. above its confluence with the Saldaña. Above this junction, the Saldaña enters a long series of narrow canyons, and although there are doubtless small flats which may have quite good values, it has never been seriously explored by anybody interested in dredgeable ground.

A short distance below the town of Ataco, the Saldaña River passes through a rather narrow valley before flowing out on the Magdalena River plains. With the exception of but one 7-km. stretch where the Saldaña River flows through the so-called San Pedro Canyon, the whole area above this lower valley is dredgeable continuously upstream on the Saldaña for a total distance of about 47 km. to the confluence of the Atá River and then up that stream for about 12 km. more. This makes a total length of dredgeable river flats of about 50 km., with but the one interruption of the San Pedro Canyon. This canyon is now traversed by a mule trail, but no problems would be encountered in building a truck road to the upper areas.

On the lower section of the area, from about 7 km. below Ataco up 26 km. to the lower end of the San Pedro Canyon, the flats have an estimated average width of at least 1,000 yd. Those of the upper section of the Saldaña, from the upper end

**THIS FLAT COUNTRY along the Saldaña River, in Colombia, is described by Mr. Troutman as being potential dredging ground worth investigating. Reports reaching E.&M.J. since this article was written indicate that such investigation is well begun, and that several groups now have parties in the area. Development of new placer properties is planned in several Colombian districts.**




**THE REGION DESCRIBED lies within the rectangle drawn near the town of Ataco. The shaded area on the smaller map of Colombia indicates the part of the country which is included in the detailed map.**

of San Pedro Canyon on 13 km. to the mouth of the Atá River, have an average estimated width of about 800 yd. On the Atá River the estimated total width of the flats for an additional 12 km. is about 500 yd.

About a year ago, an option contract on several of the lower properties near the town of Ataco was made with the Cia. Minera de Nariño, which is a subsidiary of the South American Gold & Platinum Co., of New York City. The latter part of last year, the Cia. Nariño started drilling, and since that time, the company has put down quite a number of holes. It is now working three 4-in. Ward type hand drills, and it is understood to be planning on taking in more drilling equipment. The depth to bed rock is of course variable, but it is reported that there are holes up to about 65 ft. in depth.

From their general physical characteristics, the flats of the upper Saldaña above the San Pedro Canyon and the flats of the Atá River are believed likely to carry values that will exceed those of the lower area now being drilled by the Cia. Nariño. Surface pannings taken along the river banks of this upper area vary from about 5c. to over a dollar per pan. This area has not been drilled, but it is estimated that the depth will range from about 45 ft. on the lower end to about 30 ft. on the upper end of the Atá area. From all surface indications, the gravel of these upper areas, and the general physical conditions, are more or less the same as those found in the lower area.

With the completion of the highway from the railroad station of Castilla to the town of Ataco, access to this hitherto uninvestigated region of the Saldaña has been greatly facilitated. From the town of Ataco to the village of Santiago Pérez, which is situated near the upper end of the dredging area, is a trip of about 52 km. over a fairly good mule trail.

The town of Santiago Pérez is a comparatively new settlement, having been founded only about 12 years ago as a coffee-buying and shipping center for the whole surrounding region, which is a very large coffee-producing area. The region about Ataco is given over primarily to cattle raising, and a couple of fair-sized haciendas have been established there.

The climate of the region is rather hot. Altitude is about 1,400 ft. above sea level. However, the region is quite healthful, and practically no fever exists there. The year is generally divided into a rainy season and a dry season of about equal duration.

# Flotation Machine Efficiency–A Differing Viewpoint

**K. L. SUTHERLAND,** Council for Scientific and Industrial Research, Melbourne, Australia

MY ATTENTION WAS RECENTLY DIRECTED to an article by A. W. Fahrenwald in *Engineering and Mining Journal* for January 1944, in which the efficiency of a flotation machine is judged by its ability to "grind" air. This is certainly one function that the impeller must perform, but in addition it must circulate (or pump) the liquid at sufficient speed to prevent settling of mineral. The efficiency must depend, therefore, on the size of the coarsest mineral fed.

In calculating the efficiency of a cell when bubbles of 2-mm. diameter are produced, Fahrenwald finds a value of 0.31 percent. The calculation for the figures set out is in error, the true value being 0.052 percent. That only a small fraction of energy is required to "grind" the air may be demonstrated by measuring the difference in power input when the air is switched on and off. This difference was less than 0.2 percent, equal to the experimental error here.

If we define the efficiency of the cell as the ratio of the sum of the energy required to produce bubbles ($E_1$) of certain size and the energy required to keep minerals in suspension ($E_2$) to the total energy input ($E$), *then:*

$$\text{efficiency} = \frac{E_1 + E_2}{E} \times 100.$$

The speed at which liquid in the cell must circulate is determined by the coarser part of the feed. Suppose that the material greater than 200-micron diameter is negligible: Then, to suspend particles of this size, the rising velocity of the liquid must be 6.5 cm./sec. (Calculated from Stokes' law, using a mineral density of 4 g./cc.) A test with a Denver 500-g. machine showed that the rising speed of the water was of the order of 30 cm./sec. above the impeller. The energy input was 50 watts.

Assuming the motor to be 90 percent efficient, the energy transferred to the water is 45 watts, which produces an observed velocity of 30 cm./sec. If it be assumed that the velocity produced is proportional to the energy input, a velocity of 6.5 cm./sec. would require only 10 watts. The maximum efficiency of the cell operated as outlined in the foregoing is: $\frac{0.01 + 10}{45} \times 100 = 22$ percent.

The figures of Fahrenwald's tables I and II, which are plotted herewith, demonstrate that the energy put into the cell is roughly proportional to the *mass* of the fluid circulated. The almost exact proportionality is probably a coincidence, because if it be assumed that the motor is 90 percent efficient when the cell is filled with a fluid of density 1.10 g./cc., the efficiency will drop, either when the load is lower or when the load increases beyond the optimum value.

Similarly, the impeller, if correctly designed, will operate at its maximum efficiency only when the cell is full and the fluid has a pulp density of a certain value. With decreasing depth there is greater turbulence and eddying, so that the impeller is less efficient. If there is an approximately linear change in efficiency with load, the ratio of power input to mass of liquid circulated will appear to be constant. (See the linear plots in the figures.)

That there is a decreased efficiency of the impeller is demonstrated by Fahrenwald's figures for the aëration of the cell. If the impeller efficiency were constant, the air intake would depend only on the head of fluid through which the impeller must draw air. Having the depth of the cell would therefore produce a 100 percent increase in aëration. As the figures show, the increase in aëration is considerably less.

When the pulp density is increased, the change in operating conditions is smaller, the impeller efficiency will change but slightly, and the decrease in aëration is then proportional to the increase in pulp density (Fig. 2).

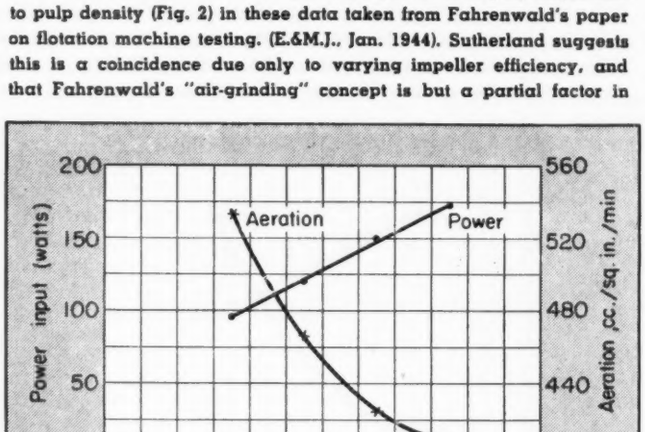
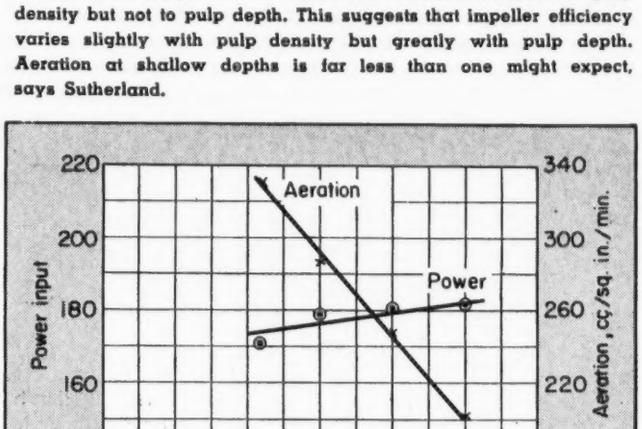



**FIG. 1. NOTE THAT POWER input is proportional to pulp depth and to pulp density (Fig. 2) in these data taken from Fahrenwald's paper on flotation machine testing. (E.&M.J., Jan. 1944). Sutherland suggests this is a coincidence due only to varying impeller efficiency, and that Fahrenwald's "air-grinding" concept is but a partial factor in machine efficiency. FIG. 2. AERATION PROPORTIONAL to pulp density but not to pulp depth. This suggests that impeller efficiency varies slightly with pulp density but greatly with pulp depth. Aeration at shallow depths is far less than one might expect, says Sutherland.**



# Modernized Device Makes Tin Plant Possible

**JOHN B. HUTTL,** Associate Editor

ANY INNOVATION IN ENGINEERING will remain unnoticed and worthless if it does not involve economic gain. The direction of employment of a technical discovery, be it a machine or a process, is determined by the economic conditions of the time. Certain requirements are now strongly emphasized; others, which in their time have been just as important, are put aside.

In brief, operating techniques and requirements as to machinery and labor never remain static, but change whenever the physical makeup of an industry or a plant is altered or new demands are made upon it.

A striking example of the shifting demands of the economy and their effect on industry is furnished by the development of the tin-recovery section of the Sullivan concentrator of Consolidated Mining & Smelting Co. of Canada, Ltd., at Kimberley, B. C. Cassiterite had been recognized in the ore when the first pilot table was started in the Sullivan mill, but the tin content was so low that no serious attempt was made to recover the mineral.

## New Method Designed

However, attractive tin prices in the late 30's changed the picture, and test work was undertaken to develop a feasible tin recovery process. This work led to the design and use of the Buckman tilting concentrator, a device that made feasible the Sullivan tin-recovery plant, which has run continuously and quite successfully since it started on March 1, 1941.

The Sullivan concentrator treats about 6,000 tons of complex lead-zinc ore daily. Tin occurs in the tailings in the form of cassiterite grains ranging in size from 200 to 1,000 mesh, which precludes the use of conventional processes. Some sulphide tin is also present. The tin mineral is about 85 percent free in the mill tailings. Size distribution is as follows:

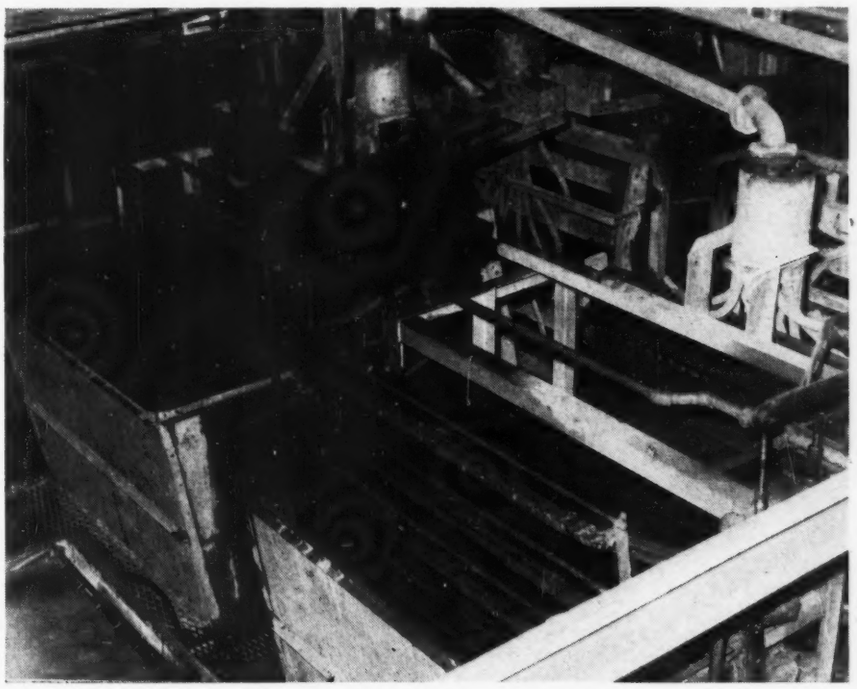
| Size Mesh | Accumulative Weight, Percent | Accumulative Tin Content, Percent |
|---|---|---|
| +200 | 20.6 | 5.9 |
| +260 | 32.4 | 24.3 |
| +350 | 47.3 | 49.2 |
| +460 | 58.8 | 64.3 |
| +670 | 67.9 | 74.3 |
| +1,000 | 75.8 | 82.4 |
| +1,500 | 82.9 | 88.6 |
| —1,500 | 17.1 | 11.4 |

## Nature of Problem

Testwork indicated that tables would recover the fine cassiterite in a marketable concentrate provided that iron sulphides were removed first. But the mill tailing is so low in tin content, about 0.065 percent, that an impracticable number of tables would have been required to treat it directly. The aim thus became twofold: (1) to secure elimination of iron sulphides; (2) to achieve preliminary concentration of tin before tabling.

The first objective posed no problem, for flotation proved able to extract 95 to 97 percent of the iron. The second objective would not yield to flotation, but the use of vanners gave some promise. The old-style machines were ruled out, however, for the same reason as were tables, but the problem of compressing large capacity into a small floor space was solved by R. S. Buckman, mechanical engineer at the Sullivan concentrator, who worked out the tilting concentrator referred to. This equipment, which is patented, is now manufactured by Denver Equipment Co. under license from Consolidated Mining & Smelting Co. of Canada, Ltd.

The concentrator unit is a tray containing a rubber-coated matting indented with grid-like depressions.



**THESE TILTING CONCENTRATORS, because of effectiveness, small floor space, and automatic operation, made possible recovery of tin from mill tailing of Consolidated M. & S. Co. of Canada, Kimberley, B. C. Feed to these units runs 0.1 percent tin; concentrate runs 5 to 10 percent, which is then small enough in bulk to table successfully.**

The tray is inclined and the tin-bearing tailing flows across it. At regular, and fixed, intervals, the feed is cut off, the tray is up-ended to a 45-deg. tilt, the tin concentrate is flushed out of it, and the tray is returned to operation.

## Clean-up Is Automatic

This action makes use of the fact that all recovery devices of the type of sluices, blankets, mats, expanded metal, or riffles do their best work in the first few minutes after a clean-up. The Buckman concentrator is merely a means of cleaning up a matting frequently and automatically, and recovery is therefore kept at a maximum.

As constructed, each unit contains five such trays each 6 x 6 ft. and made of aluminum. Twelve units make up the rougher group and about one horsepower is sufficient to tilt the twelve units in turn. Originally the units were run on a 5-min. cycle, two units being tilted and washed simultaneously; but as tonnage increased, the cycle had to be cut to 3 min., 10 sec. Feed cut-off trays, deck-tilting mechanisms, and flush water valves are synchronized mechanically through a common drive.

The place of the Buckman concentrators in the tin plant is shown in the accompanying flowsheet. The zinc rougher tailing from the sulphide concentrator contains about 0.065 percent tin, 65 percent pyrrhotite, 5 percent pyrite-arsenopyrite, and minor amounts of galena and marmatite.

The tailing reaches the tin plant in a pulp of 36 percent solids, ground to 80 percent minus 200 mesh (4 percent is plus 100 and 20 percent is minus 1,000 mesh).

To obtain a suitable density for the iron flotation step, to minimize reagent consumption, and to discard part of the slime, the zinc tailing is thickened as a first step. Overflow of the 33-ft. Hydroseparator carries about 300 tons of minus-1,000-mesh slime of insignificant tin content. Underflow is at 43 percent solids.

In the iron flotation, about 96 percent of the iron sulphide is recovered. From the 5,500 tons of zinc rougher tailing carrying 40 percent iron, 3,700 tons of concentrate is produced assaying 51 percent iron. The iron flotation tailing (1,800 tons) carries about 70 percent of the original tin content and assays about 6 percent iron. This tailing is screened to remove wood chips and fiber, after which it goes on to the tilting concentrators.

Total deck area of the 14 Buckman roughing units is 2,500 sq.ft., but because the rotating cut-off trays are deflecting 20 percent of the feed at any given time, only 2,000 sq.ft. of deck space receives feed at one time. Pulp flows onto the rougher decks at 23 to 25 percent solids and to the cleaners at 18 percent; slope of the decks is 2⅛ in. per foot. Between roughing and cleaning steps, a second flotation treatment is given the concentrate to remove any remaining coarse or oxidized iron. Product of the final cleaning operation on the Buckman machines contains about 10 percent tin.

On the tables, this grade is brought up to 66 percent tin; table tailings run about 0.7 to 1.5 percent tin and middlings about 8 to 10 percent. Over-all recovery of tin is about 42 percent at a ratio of concentration of more than 2,000 to 1. Tin metal is produced in an electric furnace at the concentrator and is equal to plus 99 percent standard tin.

The entire tin plant occupies a floor area of about 9,500 sq.ft. Power consumption is 435 hp., divided as follows: Hydroseparator, 5 hp.; pumps, 100 hp.; flotation, 320 hp.; tilting concentrators and distributors, 2 hp.; tables, 8 hp. Three men per shift operate the plant.

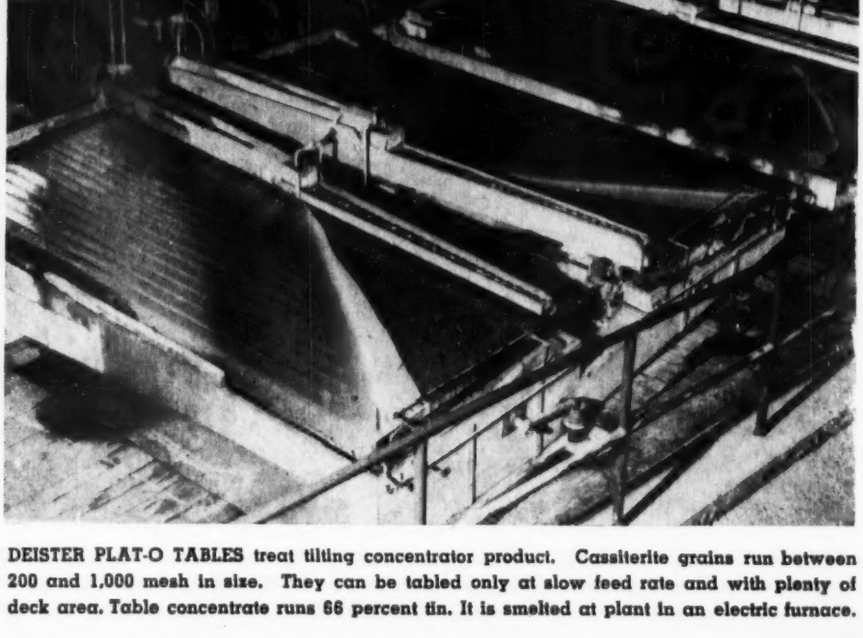
## Units Work Well

Concentration frames of tilting type are not new, but the Buckman units are new in that they use an improved deck covering and that they operate automatically. In the four years ended Feb. 28, 1945, feed to the Sullivan tin plant totaled 6,378,000 tons, of which 1,650,000 went to the tilting concentrators. Maintenance cost on the units has been low, and the rubber-coated deck covering has lasted between 20 and 30 months, depending on use.

Current feed rate per unit is excessive at 135 to 150 tons, because it requires operation at from 27 to 29 percent solids, which is higher than desirable. Recoveries have been maintained in spite of this increased tonnage, chiefly because of a coarser grind. Current feed to the tilting concentrators has the following screen analysis:

| Size Mesh | Cumulative Weight Percent |
|---|---|
| + 65 | 4.0 |
| +100 | 13.0 |
| +150 | 26.0 |
| +200 | 36.2 |
| +325 | 49.8 |
| —325 | 50.2 |

This method of preconcentration by the tilting units has proved a



**DEISTER PLAT-O TABLES treat tilting concentrator product. Cassiterite grains run between 200 and 1,000 mesh in size. They can be tabled only at slow feed rate and with plenty of deck area. Table concentrate runs 66 percent tin. It is smelted at plant in an electric furnace.**

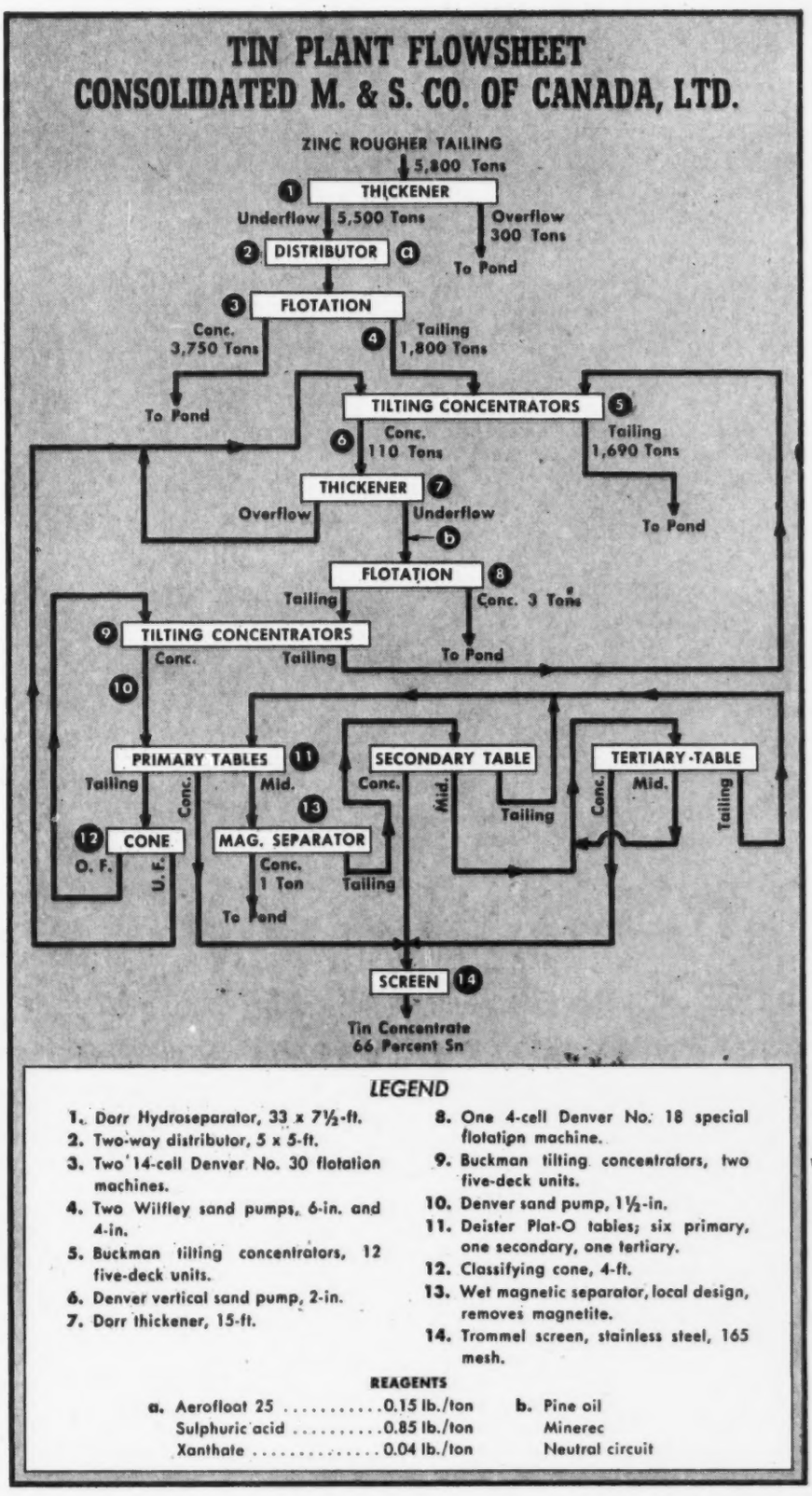
happy one. Grade is raised from 0.1 percent tin to 5 or 10 percent tin without serious loss of metal; tabling in order to produce a high-grade concentrate is made practicable; costs are kept low. The slow travel of fine cassiterite on a shaking table is well known, therefore in the final tabling step the slow feed rate and large cleaning area made feasible by the preconcentration step are advantageous. Under these conditions cassiterite as fine as 15 or 20 microns may be concentrated successfully on tables.

## Range of Applications

To date, commercial application of tilting concentrators has been limited to cassiterite. In addition to the Sullivan tin plant, several Bolivian tin mills have recently installed similar plants to treat slime. However, testwork indicates that scheelite and wolframite can be concentrated on the tilting units, and in general the field of application of the machine extends to all heavy minerals (plus 5 sp.gr.) in the size range of fine slime, which means material finer than that recovered by conventional gravity methods. For example, placer sands containing much gold finer than 100 mesh would appear well suited to the tilting concentrator.

In a suitable feed for a tilting unit, the difference in specific gravity between wanted and unwanted minerals should be at least 2.5. In the Sullivan plant, iron sulphide content has to be reduced below 10 or 15 percent before tin recovery is possible. For good recovery of material in the range of 400 to 1,000 mesh, prior classification is required. Suitable size fractions here might be: minus 65 plus 325 mesh; minus 325 plus 1,000 mesh. Bulk of the minus-10-micron slime should be eliminated beforehand. If the main values are plus 400 mesh, classification is not essential, but the maximum size of gangue should be about 65 mesh.

Separation improves with decrease in pulp density down to 10 percent solids, but a feed of 18 to 20 percent solids is usually satisfactory. Rate of flow is important and should be determined for each ore treated. The following flows are suitable for most ores: (1) for mineral minus 200 plus 400 mesh, 1.8 to 2.2 g.p.m. per foot of deck width; (2) for mineral minus 400 plus 1,000 mesh, 0.9 to 1.2 g.p.m. per foot of width. These correspond to about 75 to 85 and 35 to 45 tons per unit per 24 hr. respectively. Slope of the decks ranges from 1¾ to 2¼ in. per foot depending on the size range being treated.




### LEGEND

1. Dorr Hydroseparator, 33 x 7½-ft.
2. Two-way distributor, 5 x 5-ft.
3. Two 14-cell Denver No. 30 flotation machines.
4. Two Wilfley sand pumps, 6-in. and 4-in.
5. Buckman tilting concentrators, 12 five-deck units.
6. Denver vertical sand pump, 2-in.
7. Dorr thickener, 15-ft.
8. One 4-cell Denver No. 18 special flotation machine.
9. Buckman tilting concentrators, two five-deck units.
10. Denver sand pump, 1½-in.
11. Deister Plat-O tables; six primary, one secondary, one tertiary.
12. Classifying cone, 4-ft.
13. Wet magnetic separator, local design, removes magnetite.
14. Trommel screen, stainless steel, 165 mesh.

**REAGENTS**

a. Aerofloat 25 ..... 0.15 lb./ton
Sulphuric acid ..... 0.85 lb./ton
Xanthate ..... 0.04 lb./ton

b. Pine oil
Minerec
Neutral circuit

In conclusion, I wish to thank R. W. Diamond, vice president and general manager of Consolidated, for permission to publish this article and I gratefully acknowledge the help given me in preparing it by H. R. Banks, superintendent at Sullivan, and Arvid Thunaes, metallurgist. These men brought the tin problem through the final stages of experimentation and put the results of the test work into successful commercial operation.

# MARKET SUMMARY

AWAITING THE REPORT of the fact-finding board studying the labor dispute in the non-ferrous metals industry, sellers of copper and lead as April ended did little more than mark time. It became known that officials in Washington finally recognized the seriousness of the supply situation in these metals and were about to abandon the plan announced earlier in the year to meet higher wage costs through more liberal subsidy payments. In fact, around the middle of April it was generally believed that OPA would lift ceiling prices along the lines incorporated in the McFarland amendment to S.-2028. Testimony presented before the fact-finding board at meetings held in the West seemed to prove that the matter of granting wage increases tied to higher subsidy payments would not work. Producers dismissed the original plan presented by Bowles as impractical.

As April ended the industry hoped for speedy action to raise the ceiling on copper to 14c. or higher, zinc to 9c. or higher, and lead to 8½c. or higher. The move to raise the price of silver progressed to the point that opposing forces in the Senate had agreed on a compromise at 90c. an ounce for two years and $1.29 an ounce thereafter. Whether this arrangement will be acceptable to members of the House remains to be seen.

Consumers of copper were hampered through inability to obtain the metal in quantity in the form of wirebars and cakes. Though the stockpile of copper owned by the Government contained 444,402 tons of copper, the bulk of the supply was in shapes not in demand at present. Strikes at refineries proved to be more embarrassing because of this situation. In a statement of policy by CPA issued April 22, producers were "requested" to ration copper on a voluntary basis during the period of the emergency. The step was taken because mine and smelter production has dropped more than 50 percent because of strikes, brass mill production to 15 percent of capacity, wire mills to 25 percent and rod mills to 25 percent.

Recent purchases of foreign copper by the Government strengthened prices abroad, and quotations moved above the 12c. basis. Late in April quotations were largely nominal in the foreign market, due to smaller offerings in anticipation of a higher ceiling price for domestic metal. The British Ministry of Supply raised the price of electrolytic copper in the British market to £72 per long ton, equivalent to about 12.95c. per pound. In

## Major Metals

### U. S. DAILY AND AVERAGE PRICES

| 1946 April | Electrolytic Copper: Domestic (a) Refinery | Electrolytic Copper: Export (b) Refinery | Straits Tin: New York | Lead: New York | Lead: St. Louis | Zinc: St. Louis |
|---|---|---|---|---|---|---|
| 1 | 11.775 | 12.050 | 52.000 | 6.50 | 6.35 | 8.25 |
| 2 | 11.775 | 12.050 | 52.000 | 6.50 | 6.35 | 8.25 |
| 3 | 11.775 | 12.050 | 52.000 | 6.50 | 6.35 | 8.25 |
| 4 | 11.775 | 12.125 | 52.000 | 6.50 | 6.35 | 8.25 |
| 5 | 11.775 | 12.125 | 52.000 | 6.50 | 6.35 | 8.25 |
| 6 | 11.775 | 12.125 | 52.000 | 6.50 | 6.35 | 8.25 |
| 8 | 11.775 | 12.150 | 52.000 | 6.50 | 6.35 | 8.25 |
| 9 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 10 | 11.775 | 12.225 | 52.000 | 6.50 | 6.35 | 8.25 |
| 11 | 11.775 | 12.020 | 52.000 | 6.50 | 6.35 | 8.25 |
| 12 | 11.775 | 12.275 | 52.000 | 6.50 | 6.35 | 8.25 |
| 13 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 15 | 11.775 | 12.000 | 52.000 | 6.50 | 6.35 | 8.25 |
| 16 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 17 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 18 | 11.775 | 12.050 | 52.000 | 6.50 | 6.35 | 8.25 |
| 19 | 11.775 | 12.050 | 52.000 | 6.50 | 6.35 | 8.25 |
| 20 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 22 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 23 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 24 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 25 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 26 | 11.775 | 12.425 | 52.000 | 6.50 | 6.35 | 8.25 |
| 27 | 11.775 | 12.425 | 52.000 | 6.50 | 6.35 | 8.25 |
| 29 | 11.775 | 12.175 | 52.000 | 6.50 | 6.35 | 8.25 |
| 30 | 11.775 | 12.250 | 52.000 | 6.50 | 6.35 | 8.25 |
| **AVERAGES FOR MONTH** | | | | | | |
| Apr. | 11.775 | 12.159 | 52.000 | 6.50 | 6.35 | 8.25 |
| **AVERAGES FOR WEEK** | | | | | | |
| 3 | 11.775 | 11.996 | 52.000 | 6.50 | 6.35 | 8.25 |
| 10 | 11.775 | 12.154 | 52.000 | 6.50 | 6.35 | 8.25 |
| 17 | 11.775 | 12.137 | 52.000 | 6.50 | 6.35 | 8.25 |
| 24 | 11.775 | 12.133 | 52.000 | 6.50 | 6.35 | 8.25 |
| **April CALENDAR WEEK AVERAGES** | | | | | | |
| 6 | 11.775 | 12.088 | 52.000 | 6.50 | 6.35 | 8.25 |
| 13 | 11.775 | 12.170 | 52.000 | 6.50 | 6.35 | 8.25 |
| 20 | 11.775 | 12.104 | 52.000 | 6.50 | 6.35 | 8.25 |
| 27 | 11.775 | 12.258 | 52.000 | 6.50 | 6.35 | 8.25 |

## Silver, Gold and Sterling

### DAILY AND AVERAGE PRICES

| 1946 April | Sterling Exchange: "Checks" | Silver (c): New York | Silver (c): London | Gold: London | Gold (d): United States |
|---|---|---|---|---|---|
| 1 | 403.250 | 70.750 | 44d. | 172s. 3d. | $35.000 |
| 2 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 3 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 4 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 5 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 6 | 403.250 | (e) | (e) | (e) | 35.000 |
| 8 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 9 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 10 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 11 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 12 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 13 | 403.250 | (e) | (e) | (e) | 35.000 |
| 15 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 16 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 17 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 18 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 19 | 403.250 | 70.750 | Holiday | Holiday | 35.000 |
| 20 | 403.250 | (e) | (e) | (e) | 35.000 |
| 22 | 403.250 | 70.750 | Holiday | Holiday | 35.000 |
| 23 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 24 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 25 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 26 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 27 | 403.250 | (e) | (e) | (e) | 35.000 |
| 29 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| 30 | 403.250 | 70.750 | 44d. | 172s. 3d. | 35.000 |
| **AVERAGES FOR MONTH** | | | | | |
| April | 403.250 | 70.750 | | — | |
| **AVERAGES FOR WEEK** | | | | | |
| 3 | 403.250 | 70.750 | — | — | |
| 10 | 403.250 | 70.750 | — | — | |
| 17 | 403.250 | 70.750 | — | — | |
| 24 | 403.250 | 70.750 | — | — | |

Calendar week averages, New York Silver: April 6th, 70.750; 13th, 70.750; 20th, 70.750; 27th, 70.750.

(e) Not quoted (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis, as noted. All prices are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.225c. per pound, the average differential for freight and delivery charges.

Effective March 14, our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month.

Quotations for lead reflect prices obtained for common lead.

(c) Silver other than newly-mined domestic, by Handy & Harman. Under Treasury order of July 6, 1939, the price on domestic newly-mined silver mined subsequent to July 1, 1939, was fixed at 71.11c. per troy ounce. Handy & Harman's quotation on newly-mined domestic silver 999 fine was 70⅝c. throughout April.

London silver in pence per troy ounce.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

taking this step the British authorities in effect are no longer subsdizing consumers. It is interesting to note that the price of aluminum has been reduced in the British market to £67 per long ton, or £5 under the price posted for copper. The Ministry of Supply has purchased 215,000 tons of Canadian aluminum to be delivered in the next two years. Price paid was not disclosed.

The supply situation in lead was generally described as acute. Lead producers were asked by CPA to ration available supplies. The Government's stockpile has been reduced to 41,000 tons and frozen at that level except to take care of a few special needs. Price relief was expected hourly as April ended, and this, it was believed, will hasten the end of the strike. The Government purchased foreign lead for delivery over the second quarter on the basis of 7¾c., United States ports. The quantity obtained was small, amounting to less than 7,000 tons a month. The price situation outside of the United States was strong. The British advanced the price of lead to £45 per long ton, and zinc to £39 5s.

## Miscellaneous Metals Monthly Averages

Average prices of miscellaneous metals for March and April.

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

| | March | April |
|---|---|---|
| Quicksilver, N. Y. flask | 103.923 | 102.462 |
| Antimony (a) | 15.839 | 15.839 |
| Antimony, bulk, Laredo | 14.500 | 14.500 |
| Antimony, bulk, N. Y. | 15.265 | 15.265 |
| Antimony, Chinese (b) | 16.500 | 16.500 |
| Platinum, oz. troy | 35.000 | 35.000 |
| Cadmium (c) | 90.000 | 90.000 |
| Cadmium (d) | 92.500 | 92.500 |
| Cadmium (e) | 95.000 | 95.000 |
| Aluminum ingot | 15.000 | 15.000 |

## E & M J Price Index

Weighted index of non-ferrous metal prices (copper, lead, zinc, tin, silver, nickel, and aluminum). The average for the years 1922-1923-1924 equals 100.

| | | | |
|---|---|---|---|
| 1929 | 110.33 | 1937 | 90.86 |
| 1930 | 82.87 | 1938 | 73.67 |
| 1931 | 60.20 | 1939 | 77.71 |
| 1932 | 48.26 | 1940 | 79.22 |
| 1933 | 59.79 | 1941 | 83.49 |
| 1934 | 65.59 | 1942 | 86.80 |
| 1935 | 74.66 | 1943 | 88.74 |
| 1936 | 73.45 | 1944 | 88.74 |
| | | 1945 | 90.86 |

| | 1944 | 1945 | 1946 |
|---|---|---|---|
| January | 88.74 | 88.74 | 96.42 |
| February | 88.74 | 88.74 | 96.42 |
| March | 88.74 | 88.74 | 96.42 |
| April | 88.74 | 88.74 | 96.42 |
| May | 88.74 | 88.74 | .... |
| June | 88.74 | 88.74 | .... |
| July | 88.74 | 88.74 | .... |
| August | 88.74 | 88.74 | .... |
| September | 88.74 | 91.16 | .... |
| October | 88.74 | 96.40 | .... |
| November | 88.74 | 96.42 | .... |
| December | 88.74 | 96.42 | .... |

## Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

### MISCELLANEOUS METALS

(May 1, 1946)

| | |
|---|---|
| Aluminum, ingot, 99 plus per cent, lb. | 15c. |
| Antimony, domestic, spot, lb., 5 tons or more | 15.839c. |
| Bismuth, ton lots, lb. | $1.25 |
| Cadmium, commercial sticks, lb. | 90c. |
| Calcium, lb., ton lots, 97 @ 98 per cent, cast | $1.85 |
| Chromium, 97 per cent grade, lb. | 89c. |
| Cobalt, 97 to 99 per cent, per lb. | $1.50 |
| Indium, troy oz. | $2.25 |
| Nickel, electrolytic cathodes, lb. | 35c. |
| Magnesium, 99.8 per cent, carloads, lb. | 20½c. |
| Palladium, troy oz. | $24.00 |
| Platinum (Official quotation) troy oz. | $35.00 |
| Quicksilver, flask of 76 lb., 25 flasks or more | $102.00 |
| Selenium, 99.5 per cent, lb. | $1.75 |
| Silicon, minimum 97 per cent, spot, carloads, lb. | 14.75c. |
| Tellurium, lb. | $1.75 nom. |
| Thallium, 100 lb. or more, lb. | $12.50 nom. |
| Titanium, 96 to 98 per cent, lb. | $5.00 |

### METALLIC ORES

| | |
|---|---|
| Beryllium Ore, 8 to 12% BeO, f.o.b. mine, per unit | $8.00@$10.00 |
| Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% $Cr_2O_3$, 2.8 to 1 ratio (Prices nominal) | $41.00 |
| 48% $Cr_2O_3$ 3 to 1 ratio | $43.50 |
| Iron Ore, Lake Superior, Lower Lake ports, long ton: | |
| Old Range bessemer | $4.95 |
| Mesabi bessemer | $4.70 |
| Old Range non-bessemer | $4.80 |
| Mesabi, non-bessemer | $4.55 |
| Lead (Galena) 80 per cent, Joplin, Mo., ton | $76.01 |
| Manganese, Metals Reserve Co. sales price, per long-ton unit of Mn contained, 48 per cent, subject to premiums and penalties, effective May 15, 1944: 85c. (duty paid) New York, Philadelphia, Baltimore, Norfolk, Mobile, and New Orleans; 91c., Fontana, Calif., Provo, Utah, and Pueblo, Colo. (Prices nominal) | |
| Molybdenum Ore, 90%, per lb. of $MoS_2$ f.o.b. mines | 45c. |
| Tungsten Ore, per unit of $WO_3$: | |
| Chinese, 60 per cent, duty paid | $24.00 |
| Domestic, 60 per cent and upward | $24.00 |
| Vanadium Ore, per lb. of contained $V_2O_5$ f.o.b. mines | 27½c. |
| Zinc Ore, Prime, 60 per cent concentrate, Joplin, Mo.; per ton. | $50.00 |

### METALLIC COMPOUNDS

| | |
|---|---|
| Arsenic Oxide (arsenic) lb. | 4c. |
| Cobalt Oxide, 70 @ 71 per cent, lb. | $1.06 |
| Copper Sulphate, 100 lb. | $5.00 |

### ALLOYS

| | |
|---|---|
| Beryllium Copper, 2.5 to 3 per cent Be, per lb. of contained Be | $15.00 |
| Ferrochrome, 65 @ 70 per cent per lb. of Cr contained | 13c. |
| Ferromanganese, 78 @ 82 per cent, gross ton | $135.00 |
| Ferromolybdenum, 55 @ 65 per cent Mo, lb. of Mo contained | 95c. |
| Ferrosilicon, 50 per cent, per lb. of contained Si | 6.60@8.10c. |
| Ferrotungsten, 75 @ 80 per cent, lb. of W contained | $1.90 |
| Ferrovanadium, per lb. of V delivered | $2.70@$2.90 |
| Silicomanganese, 1 per cent C, gross ton | $138.00 |

### NON-METALLIC MINERALS

| | |
|---|---|
| Asbestos, f.o.b. Canadian (Quebec) mines (U. S. funds), ton: | |
| Crude No. 1 | $650@$758 |
| Crude No. 2 | $165@$385 |
| Spinning fibers | $124@$233 |
| Paper stock | $44@$49.50 |
| Shorts | $14.50@$26.50 |
| Vermont, f.o.b. Hyde Park: | |
| Shingle stock | $62.50@$65.00 |
| Paper stock | $44.00@$53.00 |
| Shorts | $14.50@$28.50 |
| Floats | $19.50 |
| Barytes, f.o.b. mines: | |
| Georgia, crude, per long ton | $8.50@$9.00 |
| Missouri, 93 to 94 per cent $BaSO_4$, per short ton | $8.25@$8.50 |
| Bauxite, long ton: | |
| Domestic, crude, 50 @ 52 per cent (not dried) | $5.00 |
| Domestic, chemical, 55 @ 58 per cent | $7.50@$8.50 |
| Domestic, abrasive, 80 @ 84 per cent | $16.50 |
| China Clay, f.o.b. mines, ton: | |
| South Carolina and Georgia, No. 1, bulk | $6.75@$8.00 |
| Delaware, No. 1 | $15.00 |
| Feldspar, bulk, ton: | |
| Potash feldspar, 200 mesh | $17.00 |
| Glass spar, white, 20 mesh | $11.75 |
| Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 60 per cent, all rail movement, ton | $30.00 |
| Acid 98 and 1 per cent, bulk, ton | $37.00 |
| Fuller's earth, f.o.b. Georgia or Florida, ton | $7.00@$14.00 |
| Magnesite, per ton dead-burned, f.o.b. Washington | $22.00 |
| Mica: Domestic producers quote on punch and sheet as follows: Punch, 22c. per pound; 1½x2 inch, $1.10; 2x2 inch, $1.60 2x3 inch, $2.10; 3x3 inch, $2.75; 3x4 inch, $3.50; 3x5 inch, $4; 4x6 inch, $5. Wet ground, very fine, $90 per ton. Special grades command premium. Bulk sales dry ground, $32.50 per ton; Scrap, $28 per ton and up. | |
| Ocher, Georgia, ton | $19.00@$22.00 |
| Pyrites, Spanish, per long ton unit of S, c i f. Atlantic ports | 12c. nom. |
| Silica, in bags, 325 mesh, ton | $20.00@$40.00 |
| Sulphur, Texas, mines, long ton | $16.00 |
| Talc, f.o.b. works, ton: | |
| New York, double air-floated, 325 mesh | $12.00@$15.00 |
| Vermont, extra white, 200 mesh | $9.50@$10.50 |
| Tripoli, Missouri, ton: | |
| 40 mesh, cream colored | $14.50 |

### IRON AND STEEL

| | |
|---|---|
| Pig Iron, Valley furnaces, gross ton: Basic | $26.00 |
| Steel, base price, Pittsburgh Billets, gross ton | $39.00 |
| Structural shapes, 100 lb. | $2.35 |

# WASHINGTON REFLECTIONS

*McGRAW-HILL WASHINGTON NEWS BUREAU*

## OPA Forced to Increase Metal Price Ceilings

Chester Bowles retreated from his late March statement that ceiling prices of copper, lead, and zinc would remain unchanged less than three weeks after he made it. In mid-April the director of the Office of Economic Stabilization announced standards of the Government wage-price policy under which both price and subsidy adjustments were to be made on settlement of pending wage disputes in the copper industry.

As it was explained in the official press release, "The March 28 announcement pointed out that the increased revenue required under these standards would be provided by increased subsidy payments in the case of all mines, including properties with low operating costs not previously eligible for subsidy payments.

"Today's announcement provides that increased production costs resulting from wage adjustments will be met through price increases, instead of through subsidy payments, in the case of mines not previously receiving premium payments. The price increases will be in a sufficient amount to yield the full amount of the base period (1936-39) margin of profit."

In further explanation of the action it was stated:

"The decision to meet increased production costs through price adjustments as well as subsidy payments, Mr. Bowles, said, was prompted by three principal considerations: First, the desirability of limiting subsidy payments, as heretofore, to the higher-cost mines, if this could be done without impairment of stabilization objectives; second, the need to avoid delay in bringing domestic copper prices more nearly in line with their probable postwar level and with world prices; and, finally, the conclusion after careful reexamination that a price adjustment at this time would have less serious consequences than had earlier been believed."

The copper producers were told that "A" premiums were to be the difference between 17c. and the new ceiling, to be effective the first day of the month after the effective date of the price increase.

During the last week of April it was increasingly apparent that some increases in prices of the other premium-price metals were in store, particularly in the case of lead, and notwithstanding that the request for price adjustment for lead had been turned down by OPA.

The Administration decision to let at least some of the wage increases forced on the copper producers be paid by the copper consumers rather than by the United States Treasury came just as the House was passing the much amended Spence Bill to continue the life of OPA. The introduction of Senator McFarland's bill to raise the ceiling price of copper, lead, and zinc as an amendment to the Spence Bill followed and further softened up OPA. An upward revision of ceiling prices was contemplated by OPA to forestall incorporation of the McFarland amendment in the legislation extending the life of the agency. On this subject, Washington officials outside of OPA were in unanimous opinion that halfway measures would be worse than no price revision at all. Substantial price increases which would give the larger producers greater freedom and confidence, together with subsidies for the marginal producers, would develop increased metal production within a reasonable time, in their opinion.

The McFarland amendment was vigorously supported before the Senate Banking and Currency Committee by the American Mining Congress, the Lead Industries Association, the American Zinc Institute, and other mining organizations. These groups denounced the OPA attitude as unrealistic, discriminatory, and discouraging to maximum productivity.

Final form of the Spence Bill could not be predicted in late April. At the time the House went home for its Easter recess it was apparent that the Senate would not go along on many of the restrictive amendments. If the ideas of the House and the Senate are widely divergent, it may take some time for a conference bill to be written and more time for it to be passed. Close observers of legislative action did not believe the measure would be ready for the President's signature before late June, which has led to much speculation over the possibility of a last-minute veto. This would force Congress to extend the life of OPA without change for a three-, six-, or nine-month period by simple resolution.

## Senate Group Approves Silver Price Legislation

The controversy between representatives of silver producers and users continued through April. With Senator McCarran's return, hearings on the Green bill amendment to the Treasury Postoffice appropriation bill (*E.&M.J.*, March, p. 103) were conducted in mid-April. Representatives of Western silver producers appeared in force, emphasizing that the Treasury silver was public property for currency purposes and should not be handed out at a low price to luxury manufacturers. They pointed out that the cost of silver is a minor element in the price a consumer pays for silverware; also that assistance is afforded to the production of copper, lead, and zinc by a good silver price, thus lowering the cost of these essential metals.

Without taking a vote of record, the Senate Appropriations Subcommittee on April 30 approved legislation authorizing the Treasury to purchase domestic silver on the basis of 90c. an ounce for two years and $1.29 thereafter, and resell "free" silver to commercial users on the same terms. The measure is expected to receive early approval by the full committee on Senate appropriations, following which it will be returned to the House for further action.

## House Gives Army Control of Stockpiling Policies

The Army won the third round of the battle to get a stockpile bill through Congress when the House committee reported S.752 with the Munitions Board in control rather than a civilian controlled stockpile board. The other changes made by the House committee were minor in character, such as requiring that purchases of stockpile materials be made the basis of competitive bids.

In changing the control from the stockpile board to the Army-Navy Munitions Board, the House Military Affairs Committee took stockpiling out of the direct control of the White House. As the bill was originally written, a board was to consist of the Secretary of War, who would serve as chairman, and the secretaries of State, Navy, Interior, and Commerce. This was changed by the Senate Committee on Military Affairs to a board consisting of a chairman appointed by the President with the advice and consent of the Senate, with the other members consisting of the secretaries of State, Interior, War, Navy, and Commerce as before, and with the Secretary of Agriculture and the Secretary of the Treasury added. This board was to be established within any agency of the Government designated.

The form in which the Senate passed S.752 was as the bill was rewritten in the Senate committee. It is obvious that it was the Senate's intention to give the President complete control, but the House Military Affairs Committee thought otherwise. In the version reported to the House, control of the stockpile was placed in the hands of the Army-Navy Munitions Board, where the Army dominates.

Forces were lining up in late April to put pressure on the chairman of the House Military Affairs Committee to get a rule on the stockpile bill so that action could be taken as soon as the House reconvenes after the Easter re-

cess. By the middle of May a flood of important bills will be under consideration and S.752 could easily be sidetracked in the rush. Friends of the bill believe that it can be passed by the House substantially as reported by Congressman May's committee, if he will push it.

If the House should pass the bill in the form it was reported, the Army will have won the fourth round of the battle. The final and deciding round will come when the bill reaches conference.

## Bill Would Compensate War Mineral Producers

As predicted in these pages last February, the 1946 version of the Minerals Relief Act of 1939 was introduced in the Senate in mid-April. The bill as it made its first official appearance closely followed the lines previously reported by adding a new section to the Contract Settlement Act of 1944 to give producers of strategic and critical materials treatment comparable to that enjoyed by manufacturing industries which undertook war contracts.

The definition of those eligible to collect from Uncle Sam is so broad that no producer should have the least trouble getting under the umbrella provided that in his mining operations he was "acting in good faith." The door is wide open, as proponents of the legislation have taken pains to point out.

On the other hand, S.2079 provides that the net loss shall include only that sustained between Sept. 8, 1939, and Aug. 31, 1945, except that "loss sustained in continuance of the operation or a part thereof for not more than six months thereafter in a good faith attempt to lessen the loss, and loss sustained while in good faith liquidating or attempting to liquidate the operation, shall be included."

The bill goes on to define certain losses that are to be included in figuring net loss.

Another section voids any termination agreements that may have been made between a producer and a Government agency. It is provided that claimants must file verified petitions within one year after the enactment of the new section.

The authors of the new bill closely followed the legislative and legal history of the First World War bill. Actually, much of the language was taken directly from the Minerals Relief Act of 1919, which already has had court interpretation. Sponsors of the measure believe that as a result there will be less delay for legal determination.

The bill will be pushed hard in the Senate. This is evident from the fifteen senators who joined with Senator Murray in sponsoring the new legislation. A large number of companion bills were introduced in the House when that body reconvened after the Easter recess. In the House, support was widely distributed through the non-ferrous metal-producing states.

## WAA Shuts Out New Competition in Aluminum

Disposal of Government-owned aluminum facilities was substantially completed by the lease of the Baton Rouge aluminum plant to Kaiser Cargo, Inc., and the Troutdale (near Spokane, Wash.) aluminum reduction plant to Reynolds Metals Co., announced by War Assets Administration in early April. In addition to the successful bidders, an offer was received from Asarco Aluminum Co., a corporation formed for the purpose, with 51 percent of the stock owned by the American Smelting & Refining Co.; 27 percent by the Swiss company, S. A. pour l'Industrie d'Aluminum; and 22 percent by the Dutch company, N. V. Billiton Mj.

The War Assets Administrators decision to award the plants states in part:

(a.) "The Reynolds bid for Troutdale was based on the need to supply ingot to a rolling mill at McCook, Illinois, and other fabricating plants. It follows unsuccessful efforts of Reynolds to secure substantial amounts of primary and secondary aluminum from Government-controlled stocks. Privately owned sources are believed to be insufficient to meet Reynolds' continuous needs or else are undependable. Reynolds has indicated the intention to utilize fully all of its presently controlled capacity and to use immediately all of the Troutdale capacity. It offers to lease Troutdale, paying rental initially on all four potlines."

(b.) "The lease of Troutdale would (1) help Reynolds meet a serious deficiency in primary metal; (2) strengthen its competitive position in the industry; (3) probably increase the amount of rentals to the Government resulting from a fuller use of the McCook mill and a greater use of Troutdale than the other bidders now propose; and (4) increase the likelihood that Reynolds will either maintain for a longer period the leases of McCook and other Government fabricating plants, or else ultimately purchase such plants."

Some of the things that the Government announcement did not state are that in turning down the proposal of Asarco, the only newcomer in the aluminum field adequately financed to carry on without Government loans was frozen out. The "serious deficiency in primary metal" actually was merely an inability to produce as cheaply as the metals could be purchased from other sources. So far as can be determined, there has not been a time since the war when plenty of pig aluminum was not available promptly and in any quantity. If there has been a shortage of primary metal, the shortage would have been officially declared by the proper Government agencies and purchases could then be made from the Government stockpile. Actually, the Reynolds offer was not to purchase, but to borrow Government metal.

Washington's interpretation of the leasing arrangements is that it is a confession that both Reynolds and Kaiser were permitted to acquire a lopsided group of facilities and the mistake had to be rectified by building up balanced reduction and fabricating capacity in the two companies.

## Lead Shortage Calls for Drastic Restraints

The shortage of lead was again emphasized when various Government agencies and representatives of industry met in mid-April to plan a program to increase the nation's supply of the heavy metal. It was one of the periodic meetings at which some segment of industry is told the sad facts of life as they relate to lead. There is not enough to go around. Requirements will not be met. This story has been told over and over again and still consumers go to Washington claiming ignorance of the facts. This time it was tetraethyl lead for the gasoline manufacturers. Last time it was the battery makers.

Outcome of the April meeting was an agreement to: "Intensify efforts to salvage scrap lead, strict conservation and allocation to eliminate non-essential use of lead, an effort to step up imports, special efforts to bring about early settlement of strikes, and exploration of new sources of supply both at home and abroad."

Reports that the United States Government is to increase purchases from foreign sources are without foundation. The regular purchase program will continue in force, but there will be no change in the pattern, according to high Government officials. Under the present method of operation there will be no bidding against other nations that might be competing for a fair share of the metal from foreign sources.

Production is the long-term key to the lead situation. Domestic output has been getting progressively worse, principally because of strikes.

"New United States sources of lead must be discovered," said Mr. Snyder, "if this country is to avoid becoming a 'have-not' nation as far as lead is concerned. American lead mines have been heavily drawn on during the war and for years before and may not be able to supply more than five years of future consumption."

The somber view of the future expressed by Mr. Snyder was also the basis for the reduction of allocations and permitted uses of lead for the second quarter. Further restrictions have been forecast by the Civilian Production Administration if lead supplies diminish because of work stoppages, low imports, or other reasons.

The lead conservation order (M-38) cut the second quarter allocations of lead for cable coverings, batteries, and civilian ammunition. Other regulations restricted the use of lead in insecticides, lead chemicals, and ethyl fluid from previous levels and reduced the permissive inventories from 45 to 30 days.

# NEWS OF THE INDUSTRY

## Higher Prices Seen for Industrial Diamonds

Reflecting higher production costs and the virtual depletion of stocks in the hands of producers, the average price of industrial diamonds is expected to rise, possibly as much as 60 percent, trade authorities believe. In view of the fact that prices in the war years were maintained at a low level, and that large accumulations of industrial diamonds were exhausted to meet extraordinary war demands, a rise in price under prevailing conditions is warranted, distributors contend.

Production of industrial diamonds has been averaging around 7,500,000 carats a year, whereas the United States alone consumed as much as 12,000,000 carats a year during the period of peak war production. Higher prices probably will divert attention of consumers to types of stones that were previously regarded as less desirable because of color or other more or less unimportant characteristics.

Though demand for industrial diamonds is expected to settle well below the wartime rate, consumption in the postwar period is expected to remain sufficiently high to require immediate price relief to stimulate production. At higher prices the available supply, according to informed opinion, should be adequate to meet the needs of consumers. The rise in prices, it is maintained, should not increase the cost of diamond bits for drills, diamond-set tool dies, and abrasive dust to a figure that would curb the upward trend in consumption established in these fields. However, operators who have adopted blast-hole diamond drilling are fearful that higher costs resulting from the rise in prices may restrict such operations in view of the high percentage of cost represented by diamond loss.

Industrial diamonds imported for consumption in the United States in 1940 to 1943, inclusive:

| | Carats | Value |
|---|---|---|
| 1940..... | 3,809,071 | $11,026,563 |
| 1941..... | 6,882,248 | 14,908,809 |
| 1942..... | 11,203,704 | 22,057,577 |
| 1943..... | 12,084,133 | 21,890,568 |

## May Include Geophysical Claims in Mining Code

Coming legislation which has cast its shadow before will be aimed at a revision of the mining laws. The object is to bring the regulations governing mining claims into step with modern prospecting techniques.

Under present laws a claim requires the demonstration of ore in place, either a surface showing or an exposure in a trench testpit or drill hole. This does not take into consideration the latest equipment the geologist or geophysicist may employ, which permits him to determine the probability of minerals when there is no surface indication. The airborne magnetometer is a reconnaissance tool that has come into its own as the result of the war. This and other newly developed equipment and methods have increased the scope and accuracy of the work of the geologist and geophysicist.

New legislation would take cognizance of these developments and offer protection to the prospector by permitting a geophysical mining claim. It is proposed that a definite limit would be put on the time that this claim would be in force. Six months or a year has been suggested. During this period geophysical prospecting would have to be completed.

An extension may then be available if further work seems advisable. In this period physical work could be done. On a showing of ore, means would be provided to convert the geophysical claim into a regular unpatented mining claim.

Senator Murray's mining and mineral subcommittee has such a bill under preliminary consideration.

## Fact-Finding Board Backs 18½c Increase

The fact-finding board in the nonferrous metals industry, after adjourning its Denver hearings and reconvening in Washington, on April 30 recommended a general wage increase of 18½c. per hour. The board also recommended that 5c. of this increase be made retroactive to Sept. 1, 1945, or to the date on which wage demands were presented, whichever is later.

Strikes were settled in two major districts in advance of the board's findings. Developments were as follows:

### Anaconda Copper Co.

The strike which began in Butte on April 9 terminated on April 18, when members of the International Union of Mine, Mill and Smelter Workers voted 2,048 to 277 to accept a wage increase of 18½c. an hour, or $1.48 a day. The retroactive issue, which was the sole basis of disagreement after the company's early offer of 18½c. was compromised by awarding retroactive pay of 9¼c. an hour for six months. The union had held out for increases retroactive to Oct. 1, 1945, expiration date of the former contract.

Mill and smelter workers at Anaconda and Great Falls, Mont., had deferred strike action pending outcome of the negotiations, and were not involved in the April 9 walkout.

### Coeur d'Alene District

A compromise offer of 75c. per day increase in wages retroactive to March 5, 1946, was accepted in mid-April by the International Union of Mine, Mill and Smelter Workers representing employees of companies throughout the district. Theatened strike action was halted by acceptance of the increase, which is, however, to continue effective only until such time as decisions are announced by the Government's fact-finding board. The 75c. now granted is to remain a part of any settlement, and any final contract agreed upon is to continue in force up to and including June 30, 1947.

The existing agreement lifts wages to a level probably not exceeded in any other mining district. Adjusted daily wage rates are as follows:

| | |
|---|---|
| Miner | $9.00 |
| Shoveler | 8.50 |
| Timberman | 9.50 |
| Timber helper | 8.75 |
| Machinist | 9.75 |
| Machinist helper | 8.75 |
| Carmen, trammers | 8.50 |
| Motorman (Main line) | 9.25 |
| Motorman helper | 8.75 |
| Main hoistman | 10.25 |
| Small hoistman | 9.50 |
| Nipper | 9.00 |
| Shaftman | 10.00 |
| Pump and compressor men | 9.25 |
| Surface laborer | 8.25 |
| Ore sorter | 8.25 |
| Cager | 9.25 |
| Trackman | 9.00 |
| Shift boss | 10.50 |
| Blacksmith | 9.75 |
| Blacksmith helper | 8.75 |
| Electrician | 9.75 |
| Flotation operator | 9.25 |
| Mill repairman | 9.25 |
| Mill repairman helper | 8.75 |
| Carpenters and painters | 9.75 |

### A. S. & R. Co.

The company's 18 plants in 12 states continued strike-bound at the end of April. A noteworthy development has been the union's withdrawal of its ban on plant-by-plant bargaining. Previously, the union had insisted on a single wage agreement to cover all A. S. & R. Co. plants.

## Dow Is Optimistic Over Future of Magnesium

Speaking before the New York Section, American Institute of Mining and Metallurgical Engineers, on April 16, Dr. Willard Dow, president of Dow Chemical Co., emphasized the desir-

able properties and bright future of magnesium. In his illustrated talk he pointed out that the metal can find its proper uses only when large-scale production enables minimum cost. Because of supplies of wartime metal on hand, commercial production is shut down.

In discussing the properties of magnesium, Dr. Dow mentioned its unusual lightness, its excellent machinability, strength, and capacity to enter into alloy with a wide variety of advantageous characteristics. He pointed out that its unusual resilience enables it to withstand knocks better than steel, and that it is less subject to corrosion. In regard to combustibility, he stated that for ordinary shapes and sizes this presents no hazard.

## NEWS BRIEFS

**Airborne Magnetometer.** Helicopters carrying apparatus to detect anomalies while surveying terrain from the air will provide a new method of geophysical exploration in Canada, it is reported. The apparatus is said to consist of a generator, an oscillograph with a gridded scan on which differences of magnetic intensity are recorded; two synchronized electric coils which rotate in the earth's magnetic field, cutting across the lines of force; and two motion picture cameras.

**Engineers with Knowledge of German Needed.** The War Department is in need of technical men in the field of metals and minerals. A knowledge of German is essential. Appointments are subject to Civil Service approval and are made for a minimum of six months.

**Russia Gets Hungarian Bauxite.** A recent decision of the Hungarian Supreme Economic Council has awarded Russia the right to claim as former German assets 42 percent of the shares in the Bauxite Trust Co., of Zurich, although Hungarian financial circles maintain the German share had not been greater than 34 percent. The principal asset of this company was the Hungarian Aluminum Co., which Russia now claims and will represent as a part of her capital contribution to the Russo-Hungarian Bauxite & Aluminum Co.

**Safety Conference.** The 22d annual conference of the Lake Superior Mining Section of the National Safety Council will be held at the Hotel Duluth, Duluth, Minn., June 20 and 21. The conference is sponsored by iron and copper producers of the Lake Superior district.

**New Jersey Leads in Zinc Production.** New Jersey zinc production for 1945 was 82,320 tons, according to Meredith E. Johnson, State Geologist, who reports that the State climbed from third place in -944, to first place among the nation's zinc-producing states.

## Rich Free State Borehole Booms African Gold Stocks

According to an official announcement made on April 16 by Anglo-American Corporation on behalf of Western Holdings and Blinkpoort Gold Syndicate, the Geduld Hole No. 1, which is being drilled near Odendaalsrust, Orange Free State, by the latter two companies jointly, intersected the Basal Reef at a depth of 3,922 ft. with a true width of 18.4 in. assaying 1,252 dwt. per ton. This report, indicating a value of ore of about $2,000 per ton, set off a rush to buy Free State gold stocks on the London and Johannesburg exchanges that in the first few days added over $80,0000,000 to the value of these shares.

Reason for the enthusiasm was the unprecedented value of the borehole, which no doubt led many investors to believe that a fabulous gold deposit had been found. Actually, as has been reported in E.&M.J. and other mining publications for the last two or three years, extensive drilling in the Free State has outlined a gold orebody of a grade approximating the ore of the Rand, and plans for mining it have been prepared by a number of companies. None of the scores of intersections of the main reef thus far reported has yielded values outside the range encountered on the Rand, and mining plans have been laid accordingly. No special importance is attached to the rich "strike" by most mining men, who prefer to await results of further drilling before passing judgment.

Chief importance of the rich borehole, according to Sir Ernest Oppenheimer, chairman of Anglo-American Corporation, is that it establishes the continuity of the gold-bearing reef in an area about five miles southeast of Odendaalsrust, where confirmation of its existence had been lacking. He went on to urge starting of ten or more operating companies simultaneously to permit more effective town planning.

Lying as it does at depths ranging between 3,000 and 5,000 ft., the Basal Reef under Odendaalsrust will not be reached by mine crews for perhaps five years, according to most observers. The area covered in the drilling campaigns of the last few years lies about 150 miles southeast of Johannesburg, and before any mines there can come into production, the entire range of auxiliary facilities in the way of buildings, power and water supply, stores, roads, and equipment must be provided, inasmuch as there is nothing of the sort presently available in the region.

First operating company to be formed was reported to be St. Helena Gold Mines, operating subsidiary of Western Holdings. Capitalization of St. Helena was reported as £4,000,000, and first offerings of its shares were to be made about the middle of May, although unofficial dealings in St. Helena 10s. shares were reported at 60s. from Johannesburg in April.

Despite cautionary advice from many mining men familiar with Rand deposits, public eagerness to "get in" on the new "gold strike" ran unchecked as this report was written, late in April. Free State gold stocks, and even some older Rand producers, continued the rise, with Western Holdings leading the advance. With buying orders coming in even from New York, Transvaal and Free State residents were themselves beginning to yield to the excitement, and land values around Odendaalsrust were said to be booming.

## C.I.M.M. Reviews Achievements, Foresees Expanding Horizons at Annual Meeting

Optimism for the immediate future of Canada's mineral industry, notwithstanding problems of labor, housing, and taxation, pervaded the 1946 annual meeting of the Canadian Institute of Mining and Metallurgy held at Montreal April 9, 10, and 11. Nearly a thousand representatives from all branches of the industry attended, to make this first postwar convention one of the largest on record. A broadly diversified program of technical papers and discussions combined with pleasantly interspersed social gatherings to provide abundant opportunity for the useful interchange of ideas and renewal of acquaintanceships.

R. J. Ennis, vice president and general manager of McIntyre Porcupine Mines, Ltd., was elected president of the Institute for the coming year. He succeeds Dr. Alan E. Cameron, of Halifax, Deputy Minister of Mines for Nova Scotia.

The inaugural general session on April 9 was opened by the outgoing president, who observed that an evolution had taken place during 1945 in the concept of the functions of the Institute. Dr. Cameron emphasized the Institute's part in bringing all the provincial Ministers of Mines together in a single consultative body as one of its most constructive recent accomplishments, resulting in closer contact between provincial governments and the mining industry than ever before. He also commented on the expanding interests of the Institute as evidenced by the formation of the Industrial Minerals, Coal, Geology, Metallurgy, and Metal Mining divisions.

### Blast-Hole Mining Described

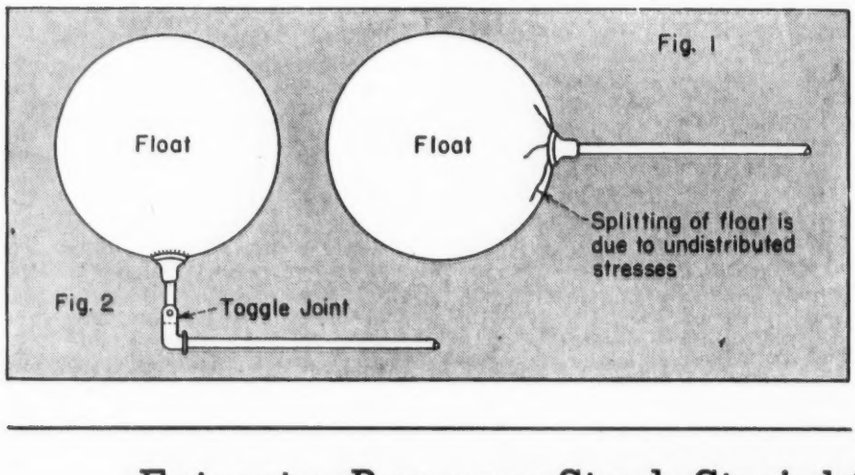
The metal mining sessions were featured by timely papers on shaft sinking, blast-hole diamond drilling, secondary blasting and car-loading, and design of rock-drill bits.

In "Blast-Hole Diamond Drilling at

(*Continued on Page* 136)

# OPERATING IDEAS

## Toggle Joint Improves Float Connection




Floats controlling water or solution valves in mines, mills, and smelters are generally attached at the end of a horizontal rod or lever as shown here. Where large valves are used, the floats exert considerable force and are likely to fail around the socket. This damage can be prevented by attaching a toggle joint as shown, so that the float exerts a pull on a short vertical rod. The stress incurred by lifting action is thus distributed over a greater surface of the float.

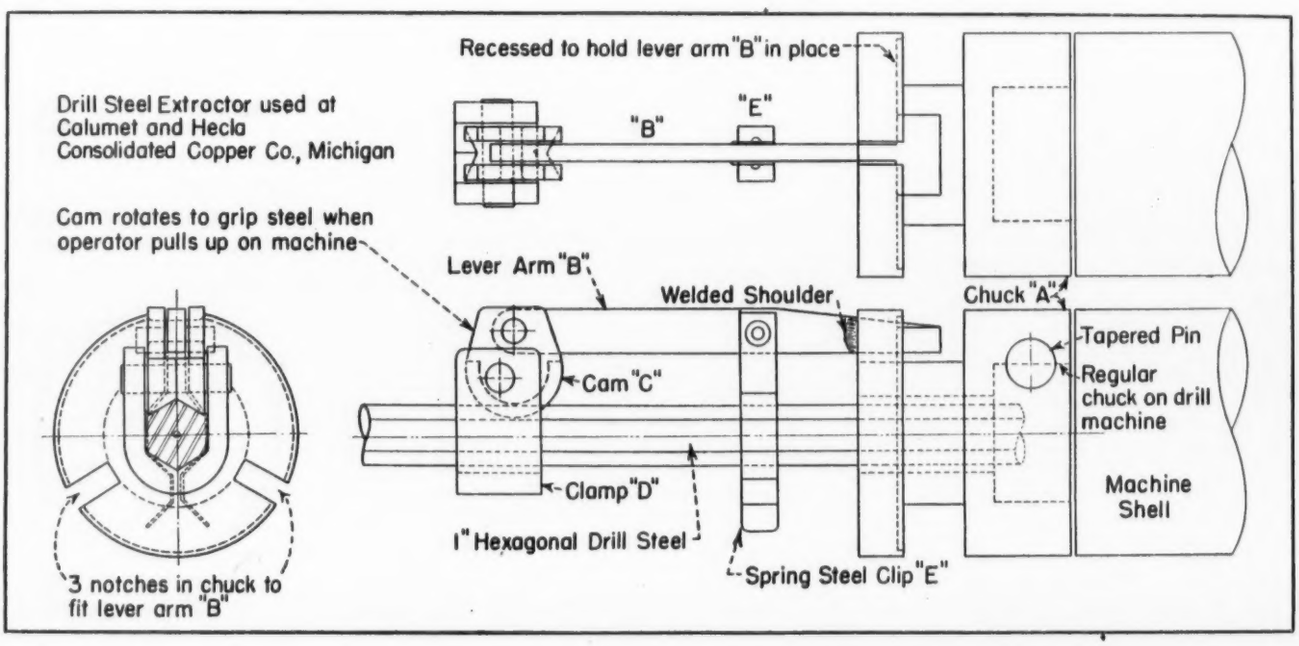
## Extractor Removes Stuck Straight-Shank Steels

This drill steel extractor was devised to remove straight shank (lugless) drill steels from down holes, such as those required for shaft work at mines of the Calumet & Hecla Consolidated Copper Co. in Michigan.

An auxiliary chuck "A" is attached to the drill machine chuck with a tapered pin. The extractor, which is separate from the drill machine and is used only when removing the drill steel from the hole, consists of a steel lever arm "B" attached to a cam "C," which is attached to a clamp "D."

When a steel becomes stuck in the hole, the drill rod is immediately detached from the machine, the extractor is slipped over the rod, and arm "B" is fastened to the chuck "A" by inserting the shoulder on the top end of "B" into the recess in the groove of chuck "A." The spring steel clip "E" springs into place around the drill rod and merely tends to hold the lever arm "B" from jumping out of the groove in chuck "A" as a result of the vibration of the drill machine. When the drill extractor is in place on the rod, the rod is pulled out from the machine about 2 or 3 in., or far enough so the hammer will not hit the drill rod when the machine is operating. The air is then turned on, and when the machine starts operating, it turns the drill rod and also the extractor.

When the operator pulls up on the drill machine, the lever arm "B" turns the cam "C" until it grips the rod, and with the rotating effort of

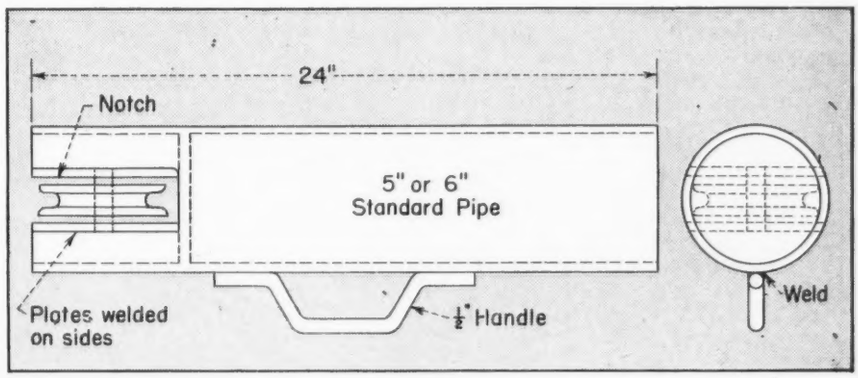

Drill Steel Extractor used at Calumet and Hecla Consolidated Copper Co., Michigan
Recessed to hold lever arm "B" in place
"B"
"E"
Cam rotates to grip steel when operator pulls up on machine
Lever Arm "B"
Welded Shoulder
Chuck "A"
Tapered Pin
Regular chuck on drill machine
Cam "C"
Clamp "D"
Machine Shell
1" Hexagonal Drill Steel
Spring Steel Clip "E"
3 notches in chuck to fit lever arm "B"

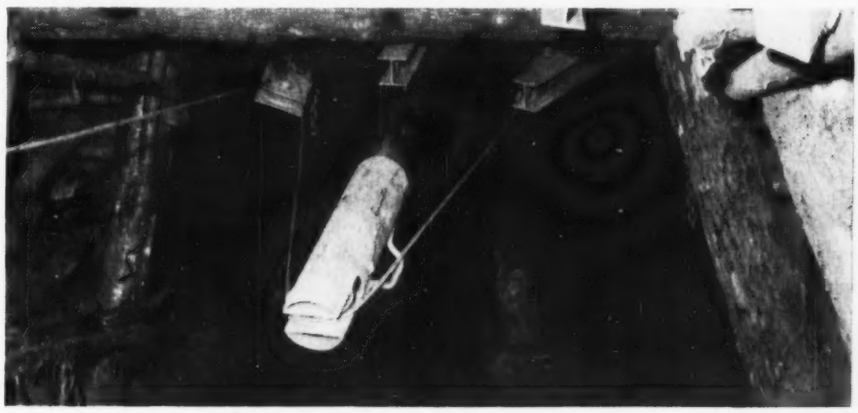
the machine, the rod readily becomes loosened in the hole and is extracted with little effort.

A short news item in the *E.&M.J.*, September 1945, which mentioned this drill extractor, prompted T. W. Greenhill, manager of Paringa Mining & Exploration Co., Ltd., Western Australia, to write in for further information. A. H. Wohlrab, general manager of the Calumet & Hecla company, has kindly released this drawing and information for the benefit of Mr. Greenhill and other mine operators.

## Slusher Hoist Drives Spiling

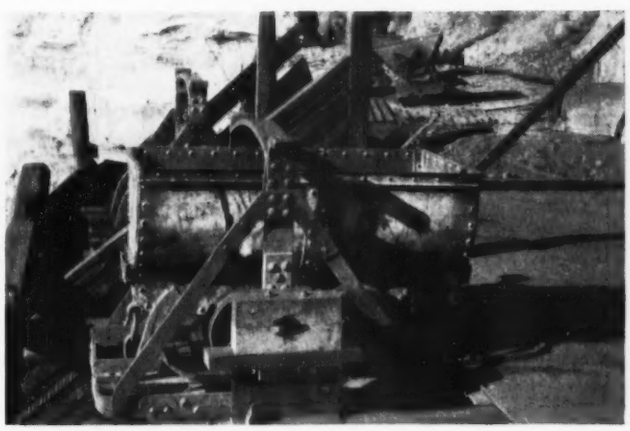
The advantages of this device will be obvious to those who have experienced the back-breaking job of driving spiling by hand with a sledge. Kasper Ranta and Reino Koski, employed at the Negaunee mine of the Cleveland-Cliffs Iron Co., Negaunee, Mich., are credited by the *Miners Safety Bulletin*, Ishpeming, Mich., with having developed the idea. It was christened a "Glory Be" as the result of an exclamation of surprise emitted by a miner who first witnessed its remarkable performance in the mine.

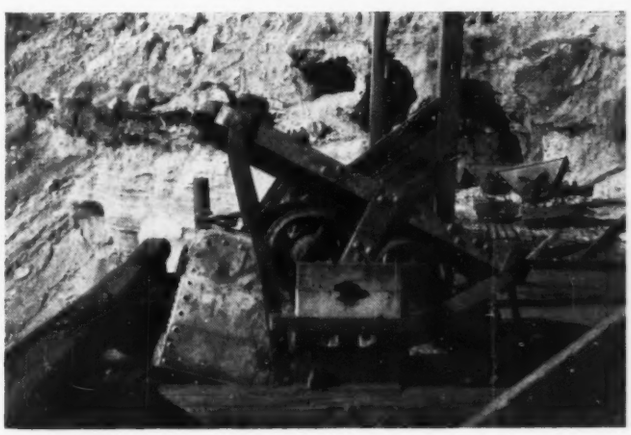


As shown in the accompanying halftone, a ½-in. cable from a slusher hoist (not shown) is threaded through a snatch block and pulley on the "Glory Be," and anchored. One end of a spile pole is inserted into the socket of the device. When power is applied to the hoist, the spile pole is driven into position. If greater mechanical advantage is desired for heavy compacted ground, a double-block arrangement may be used. Photo by courtesy of U. S. Bureau of Mines.

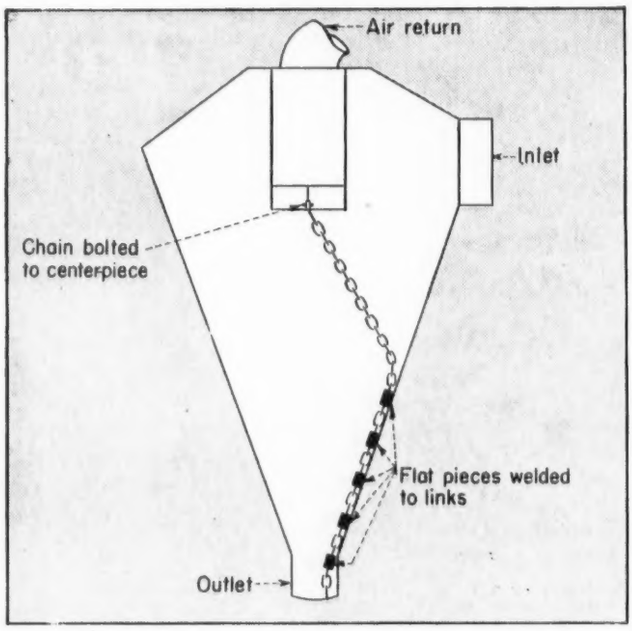
## Revolving Dump Unloads Mine Cars





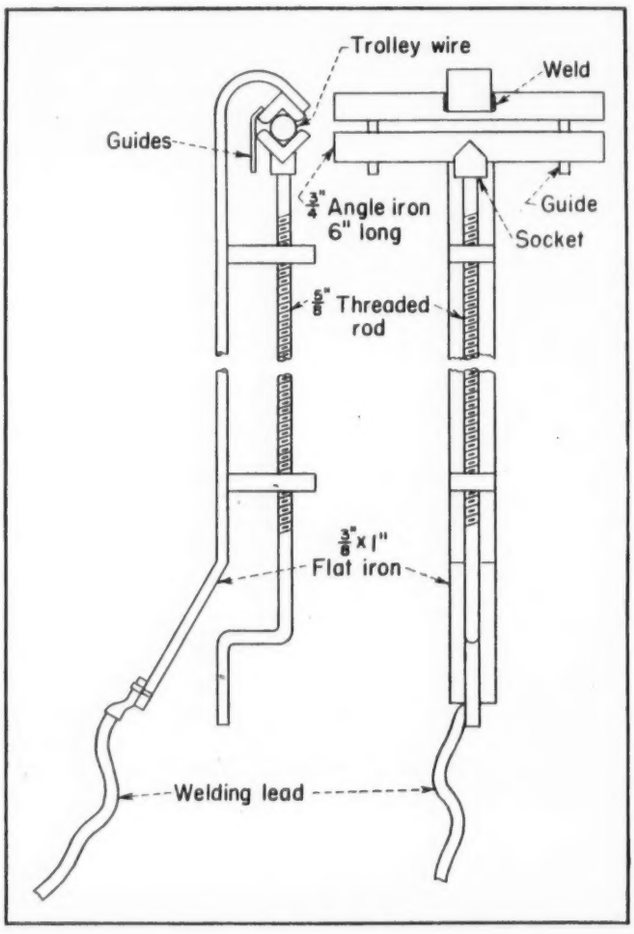
**CARS ARE UNLOADED** with a minimum of effort at a Mexican manganese property with the rotary dump illustrated in the accompanying halftones, submitted by Roger Pierce, of the Ingersoll-Rand Co. The loaded car is pushed forward on the platform until the front wheels engage two curved stops. An off-center pivot permits the dump to rotate and empty the car. It is then relatively easy for the trammer to restore the car and the dump to upright position, and remove the car from the platform.

# Suspended Chain Cleans Cyclone




Despite steeply sloping sides of cyclone installed in a crushing plant, pulverized material accumulated and fell out intermittently in large lumps. To avoid this uneven discharge, Charles Labbe, of Las Vegas, Nev., reports that mill operators adopted a suggestion of hanging a chain in the center of the cyclone as shown in the accompanying sketch. Flat pieces of ¼x1½-in. iron were welded to the ¼-in. chain links at 8-in. intervals. The whirling air within the cyclone moves the chain about slowly, thereby causing accumulations to be scraped off the sides. The chain, when hanging vertically, extends about 2 ft. below the outlet to allow for bending, which takes place during operation as shown. Although it was doubted at the time of the installation that a whirling air current could move the chain, the operators were soon convinced of the effectiveness of the device after it was tried.

# Clamp Assures Good Contact With Trolley Wire




Trolley wires are frequently used as a power source for welding track bonds. Unless a good contact is established on the trolley wire, the wire may be damaged by arcking and pitting, and in some extreme circumstances may be severed entirely.

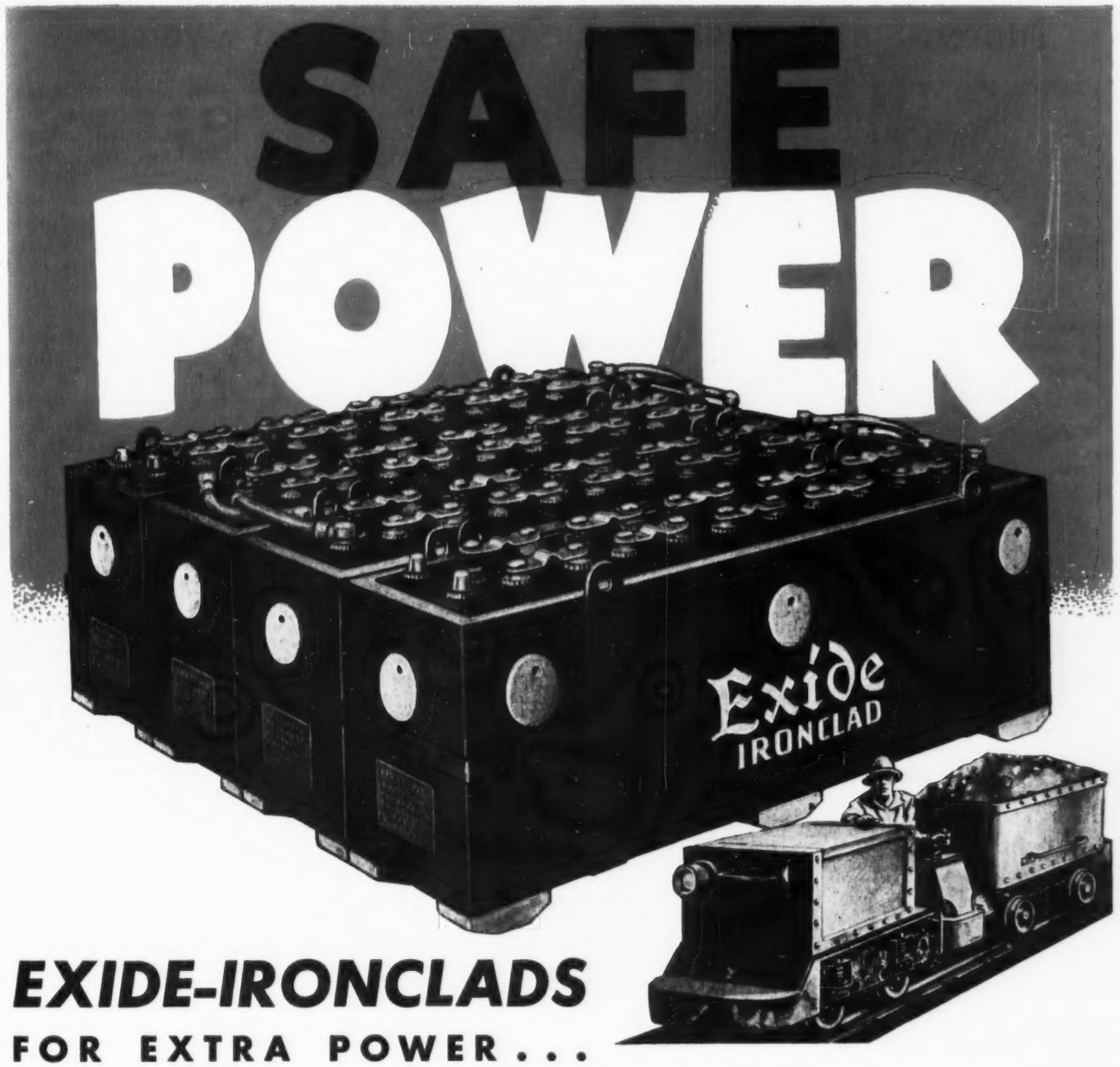
Dick May, of Wallace, Idaho, submits this sketch of a trolley wire clamp which was employed successfully to eliminate damage due to improper contacts. Two jaws, consisting of ¾x¾-in. angle irons 6 in. long, grip the wire. Pressure is applied by turning the crank on a threaded ⅝-in. rod which forces the lower jaw against the wire. The upper end of the rod revolves in a socket attached to the lower jaw. Two small guides, welded to the upper jaw as shown, prevent the lower jaw from turning while the crank is being rotated. The moving parts of the device are supported by a piece of ⅜x1-in. flat iron, to which the welding lead is attached.

It is important that the operator be fitted with dry gloves when applying the clamp, and that he take other usual precautions to insulate himself.

## Correction

*The grapple chain design which was proposed in E.&M.J. Jan. 1945 as a device for removing boulders in placer operations has aroused considerable interest, according to Buton J. Westman, mining consultant of Etna, Calif., who submitted the idea. A number of letters to Mr. Westman pointed out that the design as shown permitted the handling of only one size of boulder. Unfortunately, in preparing the drawing for publication, the chain was shown attached to the rings of the sling instead of passing through them. With the chain in the latter position, boulders of all sizes can be handled.*

# SAFE POWER

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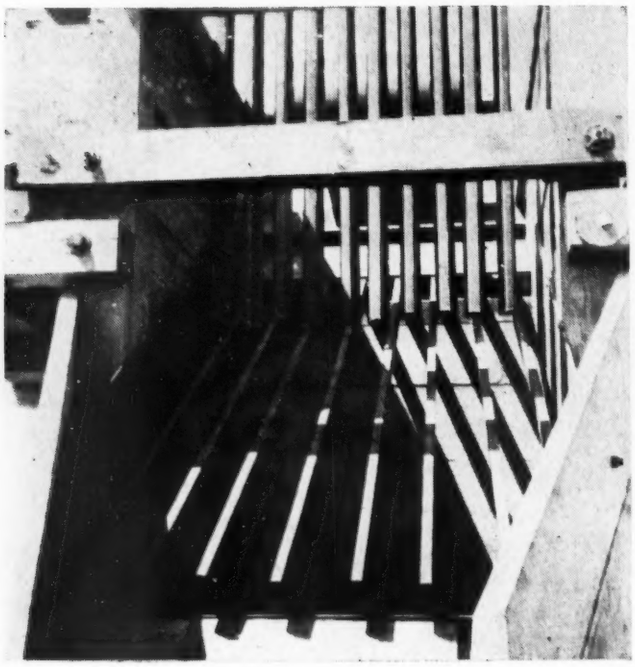
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

# "Tuning-Fork" Grizzly Frees Itself of Lodged Oversize



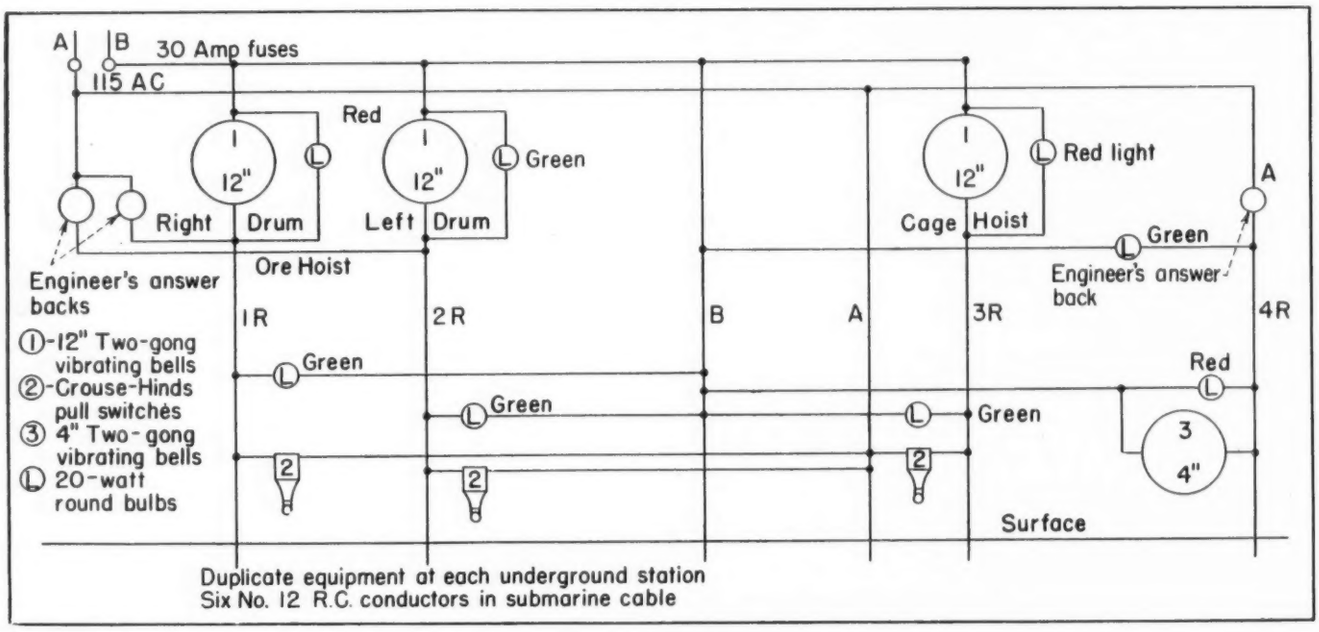
Although the principle of the vibrating grizzly is not new, readers who are unfamiliar with the device will appreciate the information on its construction and operation which H. L. Dotson, Jr., El Paso, Tex., offers here.

Tapered grizzly bars supported at two points near one end are used in the 6-ft. sloping "tuning-fork" grizzly here shown. The lower end of each bar, which is unsupported, vibrates when feed hits the bar and causes the grizzly to free itself of lodged oversize material.

One support, consisting of a bolt with pipe spacers, should be placed at the ends of the bars, and the other should be placed as a fulcrum about one-sixth of the length of the bars from the first support. The angle at which the grizzly is inclined depends upon the feed being sized. Normally for a 6-ft. grizzly, bars should be spaced ½ in. wider at the lower end than at the top.

The handling of coarse material may be facilitated by installing a baffle made of sections of light rail strung on a bar and suspended above the grizzly as shown.

# Simple Signal System Requires Little Upkeep




Low installation and maintenance costs of this hoisting signal system are due to the simplicity of design. Paul C. Ziemke, of Oak Ridge, Tenn., points out that basically two feeder wires extend the entire length of the installation, and all auxiliaries are connected thereto. A 5-kva. transformer supplies 115-v. ac. for the secondary operating with an ungrounded neutral, because signal systems operate with least interruption when free of ground.

The 20-watt green lamps in the cage tender's circuit indicate visually whether or not signals are sent accurately to the cage hoist engineer, who in turn repeats the signals by returning them over the red lamps and vibrating bell, thus rendering visual and audible check.

The circuit is also useful to supply 115-v. ac. to any shaft station for auxiliary or permanent lighting. For larger operations, a second system powered from the A and B feeders may be developed to enable the ore hoist engineer to signal the foreman and inform him of the grade of rock or ore in transit, so that he may operate controls to close or open grizzlies, or manipulate deflecting chutes in the headhouse.

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# NEW BOOKS

**MINERAL RESOURCES OF JAPAN.** Foreign Minerals Survey, U. S. Bureau of Mines, Washington, D. C. Pp. 118, plus numerous charts and separate maps.

This report is a milestone in mining literature, revealing as it does for the first time a detailed picture of the mineral industry of the Empire of Japan. Compiled by Nelson Dickerman with the aid of the Bureau's Foreign Minerals Division statisticians, it represents also the assistance of collaborating agencies, including the State Department, Foreign Economic Administration, Office of Strategic Services, Bureau of Foreign and Domestic Commerce, Department of Commerce, and the U. S. Board on Geographic Names. Twenty-three metals, nine non-metallic minerals, and coal, coke, and petroleum are covered. A 17-page gazetteer is an interesting feature, listing the important mines and metallurgical works of Japan, the oil refineries, and the mines and metallurgical plants of Korea and Manchuria, with their location by latitude and longitude.

In a general summary the review says that, although Japan was very secretive about its mineral and metal output, and although a vacuum virtually inclosed the Empire and the conquered territories after July 1937, it had been possible to get sufficient information to judge its "present position with fair accuracy." It will be appreciated that the work involved was done while the war was still in progress. The bulletin is dated October 1945, but was issued late in March, 1946.

**THE COMPLEAT RANCHER.** By Russell H. Bennett; Rinehart & Co., Inc., New York; 1945. Pp., 246. Price, $2.75.

Most mining men harbor an earthy yearning to own a farm or ranch. Here is a work, by a well-known mining engineer of Minneapolis, which tells the ambitious novice what he is headed for if he embraces ranch life. The book describes the problems, economics, tasks, hardships, customs, phraseology, joys, and rewards of Western ranching realistically, entertainingly, and understandably. Recommended for readers who contemplate a home on the range.

**MINERALS REVIEW OF LATIN AMERICA, 1939-44.** Foreign Minerals Survey, U. S. Bureau of Mines, Washington, D. C. Pp. 112, plus charts.

In addition to the Latin-American countries, this survey also covers British Guiana, British Honduras, British West Indies, Dutch Guiana, and Netherlands West Indies. Though October 1945 is given as the month of publication, the report became available late in March 1946. The issuing office asserts that it represents the first attempt to present the detailed production and export statistics of the Latin-American countries during the war period, so far as it is aware. The tabulations given and the discussion of values affecting trend are of chief value. The report should be most useful as a work of reference.

**FIAT MONEY INFLATION IN FRANCE.** By Andrew Dickson White; published in "The Freeman," Vol. II, No. 3, by Pamphleteers, Inc., 725 Venice Blvd., Los Angeles 15, Calif.; 1945. Pp. 69. Price 50c.

Because of their interest in currency matters and their general disposition toward "honest" money, miners will applaud the lesson recorded in this concisely written pamphlet, describing the fearful consequences of a paper-money debauch during the French Revolution. This effort to solve financial problems painlessly and to bolster a sick economy by price regulation is alarmingly parallel to the present situation and philosophy in this country. It should constitute a timely warning to thoughtful people today.

**HOW TO FIND A SHORT AND OTHER AUTOMOBILE WIRING TROUBLES.** By Jack Steele. Norman W. Henley Publishing Co., 17 W. 45th St., New York 19, N. Y. Pp. 209. Price $2.

Fifty case histories are included, illustrating the actual workshop experience of the author, who is California State Headlight Inspector. The book purports to give the answers to all automobile light and wiring troubles.

**STEEL IN THE WAR.** United States Steel Corporation, 71 Broadway, New York. Pp. 164.

More than 200 photographs have been used in this 9x12¼-in. book in telling the story of the part played in the World War II by the American steel industry, in particular by the United States Steel Corporation—a story that had to be deferred until the war was over. Facts and figures are presented which measure the importance of steel to national security. Every phase of this basic industry is covered. An adequate index at the end gives lasting value to the volume as a book of reference, which has been made available to thousands of libraries throughout the country.

**THE BRITISH ENGINEERS ASSOCIATION CLASSIFIED HANDBOOK OF MEMBERS AND THEIR MANUFACTURERS.** 1945 Edition. 32 Victoria St., Westminster, London, S. W. 1. Pp. 604.

This volume is intended to help sell engineering plant, machinery, and accessories of British manufacture. It is stated that an effort has been made to produce a thoroughly comprehensive work of reference to the products of the Association members. An alphabetical list of the members occupies 127 pages. This is followed by 329 pages of advertisements. The rest of the book consists of a classified list of manufacturers.

## PUBLICATIONS RECEIVED

**Potash Reserves of the United States.** Are Agriculture and Industry Threatened by Approaching Exhaustion of Domestic Reserves? By Samuel H. Dolbear. American Potash Institute, Inc., Washington, D. C. Pp. 20. (See editorial on page 55).

**The Economics of the Potash Industry.** By Jules Bachman. American Potash Institute, Inc., Washington, D. C. Pp. 55. (See editorial on page 55).

**Director of the Mint. Annual Report for Year Ended June 30, 1945.** Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. Pp. 97. Price, 20c. (Paper.)

**Method of Platting Projections of Crooked Bore Holes.** By L. E. Shaffer. Bulletin of Missouri School of Mines and Metallurgy, Rolla, Mo. Pp. 14.

**Utah.** Industrial Commission Biennial Report for period ended June 30, 1944. Contains list of addresses of Utah mining companies by counties. Pp. 77.

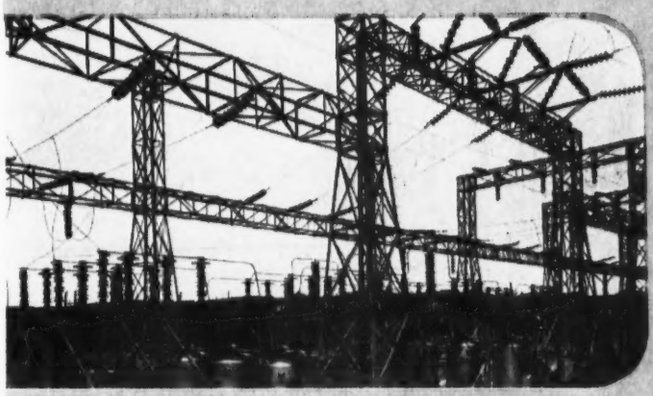
**Canada.** Preliminary Report on Mineral Production. Dominion Bureau of Statistics, Ottawa. Pp. 45. Price, 25c.

**Ontario Department of Mines.** Annual Report, Vol. LI, Part I, 1942. Includes statistical review of mineral industry, 1941; a list of mines for that year, and summaries of their operations. Pp. 282.

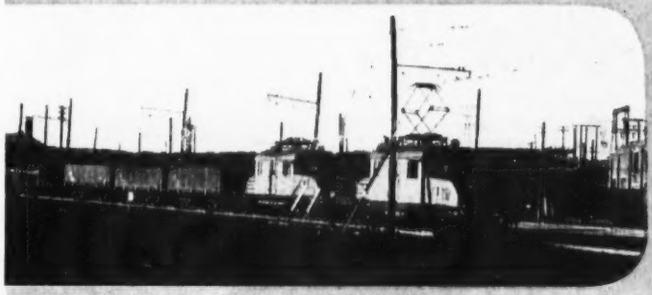
**Ontario.** "Mattawan-Obrig Area, Geology of," and "Brazeau Vanadium-Bearing Magnetite Deposit, Papineau Township." Papers in Annual Report of Ontario Department of Mines, Vol. LIII, Part VI, 1944. Toronto, Ont. Pp. 55, plus maps.

(*Continued on page* 141)

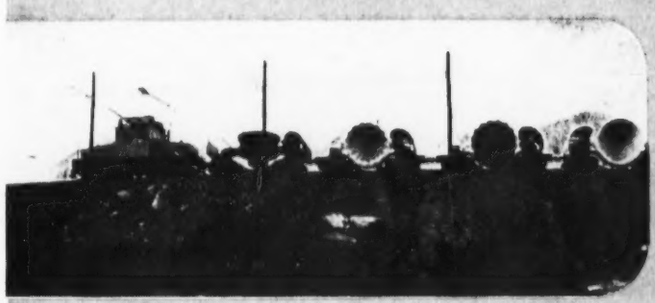
# FOR LOW-COST ORE HANDLING...



O-B High-Voltage Insulators serve the main outside incoming power station at INCo's Copper Cliff Concentrator.



Powerful electric locomotives operating under O-B Overhead bring a trip of ore cars into the smelter yard. Electrified haulage is particularly well-adapted to the peaks and valleys experienced in smelter yard operation.



Electrified haulage extends to the International Nickel dump permitting low-cost slag removal, as well. Overhead structures are portable to facilitate movement as operations extend, and are equipped with O-B Trolley Line Materials.

## International Nickel Operates Vast Electrified Haulage System

We think it significant that electrified haulage has been permitted to play an important part in the operation at International Nickel where millions of tons of ore are moved annually... ore which produces over eighty per cent of the world's nickel, large quantities of copper and sizable amounts of silver, gold and platinum metals. We think it further significant that O-B Line Materials, Rail Bonds and High-Voltage Insulators have been used throughout the INCo system, contributing to its transportation efficiency.

2712-M

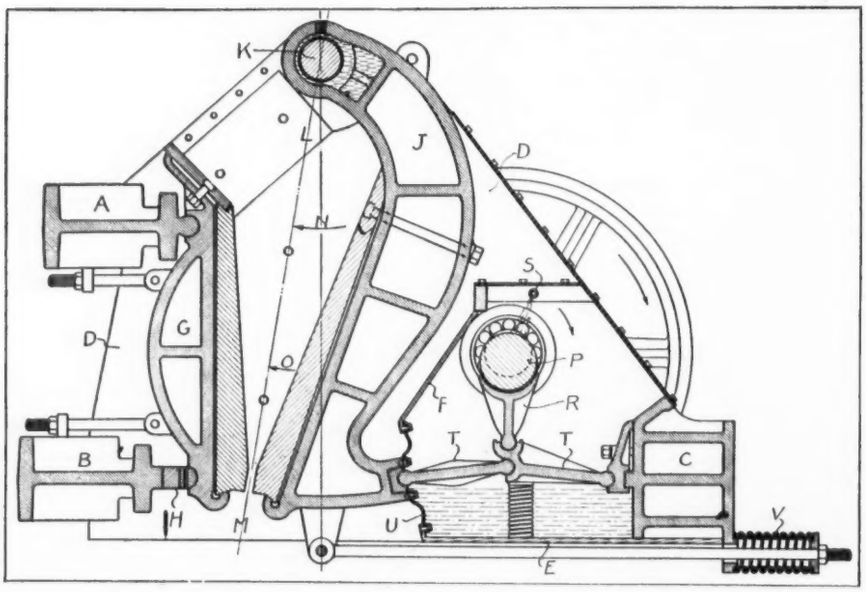
Ohio Brass

MANSFIELD, OHIO

Canadian Ohio Brass Co. Ltd. Niagara Falls, Ontario

# EQUIPMENT NEWS

## Improved Jaw Crusher Uses Little Power



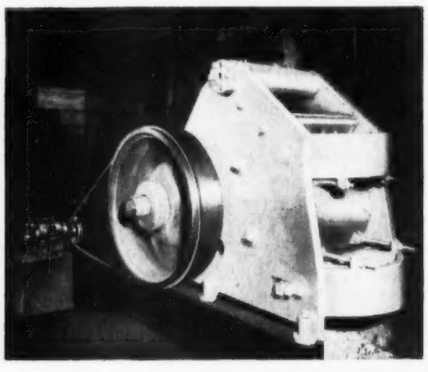

Several innovations in design have combined to make the new Simplex jaw crusher, recently announced by Straub Manufacturing Co., 507 Chestnut St., Oakland, Calif., a particularly interesting development. Features of the new machine are reported to be: startlingly low power requirements; low wear on jaw plates; high speed operation; effective lubrication; high crushing capacity.

Constructional details of the Simplex crusher are given in the accompanying drawing. Heavy steel side plates (D) are held together by steel cross members (A, B, C). Plates (E) and (F) form an oil bath and storage tank. The stationary jaw (G) is held firmly against the front cross members, but shims (H) are easily adjusted to change the size of the crushed product without disturbing the geometry of the crushing motion. The massive swing jaw (J) hangs freely on hinge (K), and bearings and trust faces are flooded with oil at all times by the oil bath lubrication system installed in the jaw.

An examination of the drawing shows that the location of the hinge pin requires that the jaw motion follow the arrows, N and O, and consequently rock is nipped and crushed with minimum slippage. Wear of jaw plates is therefore less than in conventional Blake or overhead eccentric crushers and crushing action is faster.

The eccentric shaft (P) of the Simplex crusher is mounted in two large self-aligning roller bearings pressed into the side frames. The throw on this shaft is exceptionally large, which permits the toggles (T) to be set in the most advantageous, relatively flat position. The pitman (R) is a simple, light but strong steel member, always stressed in compression, with the upper end bearing only against the lower side of the eccentric shaft. Note that the pitman does not pass through or between the toggles. The net effect of this design is that greater leverage is applied to the swing jaw, yet pressures on pitman and shaft bearings are lower than in other crusher designs. The crusher runs at 350 to 400 r.p.m.

The crusher lubrication system includes a positive-type pump, driven from the crusher shaft, that draws oil from the reservoir through a strainer and a filter and on through manifold (S), whence about 5 g.p.m. flows down over the shaft, pitman, and toggles. A pressure gage is supplied and in addition a pressure switch can be set to shut off the crusher if oil pressure drops below a set minimum. The crusher is protected against tramp iron by an overload safety device built into the hub of the drive pulley.

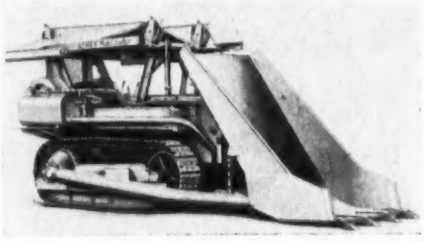


A conventional jaw crusher, running empty, uses about 50 to 70 percent of its full load power demand, and it should have a motor about 125 percent oversize to start it. The 30x15-in. Simplex crusher shown in the accompanying photograph was driven by a 5-hp., 1,800-r.p.m. motor with an across-the-line starter and one V-belt. The motor started the crusher and brought it to full speed of 380 r.p.m., whereupon tests by independent engineers showed a net power demand of 1½-hp. A 30x18-in. old-style unit running at 225 r.p.m. would require a 50-hp. motor to start it, and would then draw 20 to 28 hp. even running empty.

The Simplex crusher pictured was tested in the field with a 7-belt 20-hp. motor. It was choke-fed with run-of-quarry hard andesite, crushing to 3½-in. at 75 tons per hour, and power demand ranged from 8 to 24 hp. In another field installation with a 20-hp. motor, rhyolite is crushed to 2¼ in. at a rate of 60 to 80 tons per hour, and after six months of operation there has been no loss of oil nor need for a single repair.

## Improved Earth Mover

Announcement has been made by Athey Products Corporation, Chicago, Ill., of an improved Mobiloader to be known as Model W4-5. Engineered for use with the wide-gage Caterpillar D-4



tractor, the new unit incorporates a finger tip hydraulic control that is said to decrease operator fatigue and increase loading effectiveness. Other design changes include improved mounting arrangements that balance the load on the tractor, decrease wear on idlers and rollers, and facilitate maintenance.

## Hydraulic Classifier

Four new construction principles are employed in designing a hydraulic classifier described in a recent publication of the U. S. Bureau of Mines. The device was developed at the Bureau's Southern Experiment Station at Tuscaloosa, Ala., and was found particularly effective in treating iron ores. In one

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U. S. Bureau of Mines
Information Circular I. C. 7302
November, 1944

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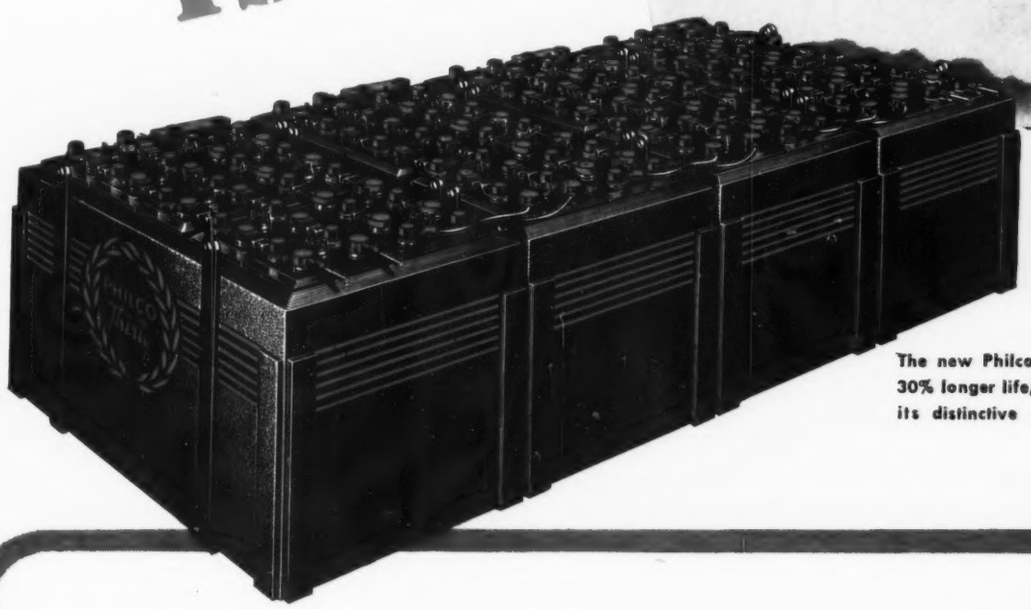

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test the new unit recovered four tons of concentrate per hour from a table middling that would otherwise have had to be reground and retabled. Details of the classifier are given in the Bureau's Report of Investigations No. 3844.

## Shovel and Crane

The first postwar shovel and crane to be put on the market was announced recently by Thew Shovel Co., Lorain, Ohio. The new Model TL-20 is offered in either crawler or rubber-tired self-propelled mountings, and it can be equipped with a choice of five inter-

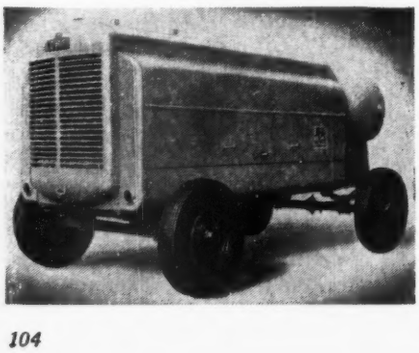
changeable booms. An important feature of the turntable is a unit assembly design, whereby each major component can be removed and replaced as a unit. According to the manufacturer, both derrick booms and shovel attachments have been newly designed to provide several operating advantages. Full details will be furnished on request.

## Long-Haul Conveyor Belt

Replacing an installation in which three belts in series had been used, a single-cord Goodrich belt on the Minnesota Iron Range now hauls an hourly average of 900 long tons of iron ore. The belt is 30 in., eight-ply, 1,556 ft. center-to-center, with an over-all lift of 149 ft. It runs 550 ft. per minute, and was made endless on the job. The head pulley for the belt is driven by 100-hp. motors, one on either side, and the secondary pulley is driven by one 100-hp. motor.

## Portable Air Compressors

A completely new line of portable air compressors has been announced by Le Roi Co., Milwaukee, Wis. Known as the Airmaster series, the new compressors



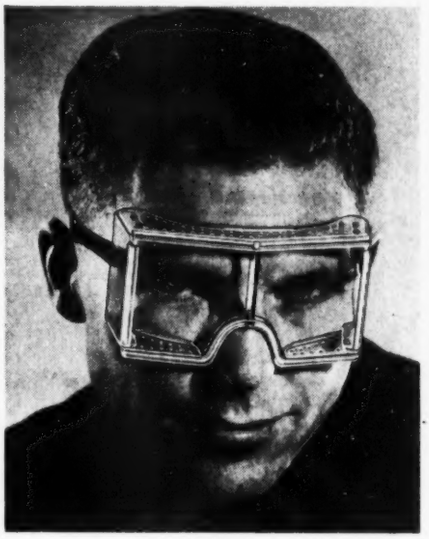
will be offered in 10 models: 60 to 315 Le Roi gasoline engine powered; and 105 to 500 full diesel engine powered. Among the several new design features is the first general use of the Le Roi Econotrol, an automatic speed-pressure governor. A wide range of mountings is available, and operator safety and convenience are said to be stressed through application of field-proved control and operating equipment items.

## Power-Factor Regulator

The Haug System power-factor regulator is announced by Modern Control Equipment Co., 176 West Adams St., Chicago, Ill. The makers state that the unit will reduce the monthly power bill of commercial power users by increasing the power factor. Full details will be furnished on request.

## All-Plastic Goggle

All-plastic safety goggles made by Watchemoket Optical Co., Inc., Providence 3, R. I., are now offered with a new plastic frame that is said to wear longer and provide better ventilation than previous models. The new goggle



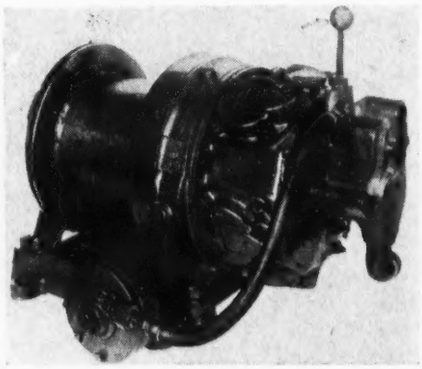
is said to provide protection against injury from top, sides, and bottom. It is light in weight and can be worn over regular glasses without discomfort.

## Heavy-Duty Tires

Equipped with a tread designed to meet needs of vehicles that operate both on and off the highway, a new type truck tire has been put into production by Goodyear Tire & Rubber Co., Akron, Ohio. Known as the Hi-Way Lug, the new tire has a deep, non-skid, extra-heavy tread plus extra strength in the rayon cord body of the tire. Lugs are placed close together to provide smooth rolling on a highway, yet extra traction off the highway is provided by the alternate long-and-short design of the lugs.

## Safer Mine Hoist

The small air hoist, Model HKK, made by the Gardner-Denver Co., and used in mines for hoisting timber, steel, and other supplies, is now being manufactured with a spring-loaded brake, which is held in the off position by the



air pressure that operates the hoist. If for any reason the air pressure fails, the brake is applied automatically. The brake will hold in suspension any load within the capacity of the hoist, and it cannot be released until air is again applied to the motor and the load picked up. The hoist has a rated lift of 2,000 lb. at 80-lb. pressure.

## Drilling Concrete

New England Carbide Tool Co., 60 Brookline St., Cambridge, Mass., recently announced the addition to its standard tool line of a carbide-tipped Cyclone drill bit, which is used for drilling holes in concrete, masonry, brick, tile, and marble. An ordinary rotary electric drill is used. The bit is available in stock sizes from 3/16 in. to 1½ in., by sixteenths.

## Fan-Cooled Motors

New totally-inclosed fan-cooled electric motors, especially designed for use in extremely dusty, dirty, or corrosive locations, have been announced by General Electric Co., Schenectady, N. Y. An addition to the company's line of Tri-Clad induction motors, the new units are available in standard explosion-proof types from 1 to 1,000 hp. Several new and interesting design and operating features are incorporated in the motors.

## INDUSTRIAL NOTES

**D. W. Marshall,** formerly in charge of ventilation tubing sales for **Bemis Bros. Bag Co.,** St. Louis, Mo., resigned April 1 to become sales manager of **American Brattice Cloth Corporation,** Warsaw, Ind.

**Caterpillar Tractor Co.,** Peoria, Ill., announces plans for expanding floor area of its Peoria plant by 50 percent.

(*Continued on page* 142)

# EDISON

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The benefits of better safety, conferred by the working combination of Edison Electric Cap Lamps and M.S.A. Skullgards, promote increased production wherever this equipment is employed. *More effective light* reduces unseen hazards and speeds the job . . . *proved head protection* guards against overhead dangers and increases comfort. Let Edison Lamps with M.S.A. Skullgards serve *your* mining operations—ask for a demonstration!

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# PERSONAL NEWS

**Robert E. Crockett,** mining engineer with H. A. Brassert & Co., New York, was in Santiago, Chile, recently.

**L. Boomgaart,** formerly geologist with Marsman & Co., Manila, P. I., has been a prisoner of war in Java. He is in excellent health, and working as supply officer of the Borromeus Hospital, in Bandoeng, Java. He would appreciate it very much to receive some news from his friends in the Philippines.

**J. C. Dumbrille** has been appointed general manager of the Highland-Bell, Ltd., Beaverdell district of British Columbia, following purchase of control by Leitch Gold Mines, Ltd., in northwest Ontario. **Alan B. Staples** will continue as mine manager.

**Art Stollery** has been appointed mine manager and **Al Smith,** geologist, of Pacific (Eastern) Gold, Ltd., in the Bridge River area of British Columbia.

**James Walter Christie,** chief of the accounting department of the Mexico City offices of American Smelting, recently celebrated his 50th consecutive year in the company's employ. Mr. Christie entered American Smelting's service at the age of 12 as an office boy for the general manager of the company's El Paso (Tex.) smelter.

**Ira Odgers,** contractor for iron ore diamond drilling, with headquarters at Iron River, Mich., has changed his company to a partnership. His son, recently released from the defense forces, has joined with his father in the business.

**Felton Gibbons** is retiring after 32 years as resident manager for the Norton Co., bauxite mining and processing organization. He will be retained as consultant to his successor, **C. Lawton Rucker,** who began his duties in April.

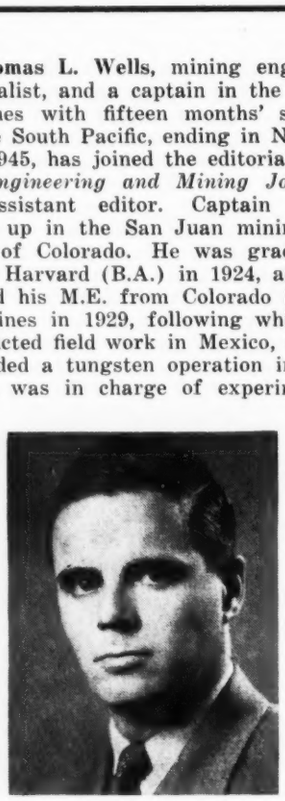
**Dr. Charles F. Park, Jr.,** mining geologist and until recently U. S. Geological Survey executive in charge of the section on metalliferous deposits, has been appointed professor of geology at Stanford University, California.

**Karl J. Springer** has been elected president of Pinebrayle Gold Mines, Ltd., operating in British Columbia. **John Watson** is vice president and **J. C. Dumbrille,** managing director. **G. A. McPherson** and **Neil McDiarmid** are directors.

**Dr. Austin W. Fisher** and **Dr. Bruce S. Old** have joined the staff of Arthur D. Little, Inc., Cambridge, Mass., an industrial research organization.

**Neil O'Donnell,** general manager, Idaho Maryland Mines Corporation, Grass Valley, Calif., has been elected executive vice president of the corporation.

**Thomas L. Wells,** mining engineer, journalist, and a captain in the U. S. Marines with fifteen months' service in the South Pacific, ending in November 1945, has joined the editorial staff of *Engineering and Mining Journal,* as assistant editor. Captain Wells grew up in the San Juan mining region of Colorado. He was graduated from Harvard (B.A.) in 1924, and received his M.E. from Colorado School of Mines in 1929, following which he conducted field work in Mexico, superintended a tungsten operation in Arizona, was in charge of experimental



THOMAS L. WELLS

deep-hole drilling and metallurgical test work in Chile for the Braden Copper Co., and was engaged in various technical and executive capacities with Ventures, Ltd., Toronto, in the course of which he developed and brought into production Matachewan Consolidated Mines, Ltd., at Matachewan, Ont. In 1937 he engaged in independent consulting work in Toronto. In 1940 he became associate editor of *Explosives Engineer,* a Hercules Powder Co. publication, and in 1942 he was appointed editor of that magazine. In the same year he was commissioned a first lieutenant in the Marine Corps, returning from service last year with the rank of captain. He is a member of the A.I.M.E. and the Canadian Institute of Mining and Metallurgy.

**Erle C. Annes** recently established the Annes Engineering Co., Bates Building, Grants Pass, Ore. The company will specialize in consulting mining engineering and geological service, surveying, and assaying.

**Dr. Frank A. Swenson,** a geologist on the staff of the U. S. Geological Survey, has been awarded the Bronze Star by the Navy Department for outstanding contributions to the success of the Okinawa campaign as a member of the Military Geology Unit of the Survey.

**J. T. Boyd,** manager of the New Goldfields of Venezuela, has returned to the United States, and his place as general manager has been taken by **C. Norman,** who was previously manager of Abontiakoon mine, West Africa.

**Walter F. Pond,** formerly State Geologist of Tennessee for 18 years, has accepted the position of geologist for the Magnet Cove Barium Corporation at Malvern, Ark. In addition to handling the company's geologic problems in connection with Arkansas barite deposits, Mr. Pond will investigate and do geologic work on other mineral holdings of the company in various parts of the United States. His headquarters will be at Malvern, Ark.

**Alfred D. Rood,** formerly assistant chief mining engineer for the Inspiration Consolidated Copper Corporation at Inspiration, Ariz., has accepted the position of mining engineer with the Magnet Cove Barium Corporation at Malvern, Ark. Mr. Rood will be in charge of the proposed underground mining of the company's large barite deposit near Magnet Cove, Ark. His headquarters are at the company's offices in Malvern.

**Leslie E. Harris** has been appointed mill superintendent of the 4C concentrator of Cananea Consolidated Copper Co., S.A., at Cananea, Sonora, Mexico, succeeding **Frank J. Strachan,** who has retired after 40 years' service with the company. Mr. Harris was transferred from open-pit operations, where he was general mill foreman of the new 12,000-ton-per-day concentrator.

**Earl Beistline** has succeeded **Prof. Lou Jordan** on the teaching staff of the School of Mines at the University of Alaska. Professor Jordan resigned to resume active mining work. Mr. Beistline, recently discharged from service as a major in the Chemical Warfare division of the Army, is a graduate of the University of Alaska.

**William J. Bennett** has resigned as chief executive assistant to Reconstruction Minister Howe, at Ottawa, and has become vice president and general manager of Eldorado Mining & Refining, Ltd., and president of Northern Transportation Co. His headquarters will be in Toronto.

**Jay J. Seaver,** vice president of Day & Zimmermann, Inc., opened an engineering office on May 1 under the name of Jay J. Seaver Engineers, in Chicago, at 100 North La Salle St.

**Thomas L. Chapman** is the new general manager of the Tennessee Schuylkill Corporation, near Chloride, Ariz.

**William H. Wainright,** who was engaged on the design and erection of a plant at the steel works of the Broken Hill Proprietary Co., Ltd., at Newcastle, New South Wales, is now metallurgist at the company's Hannan's

North Gold Mine, at Kalgoorlie, Western Australia.

**Dr. B. H. Moore** has retired from the position of director of the Kalgoorlie School of Mines, Western Australia, after 38 years' service.

**Keith S. Black** has been appointed mine manager of King Island Scheelite, N. L., King Island Australia. Prior to his acceptance of the position, he was on the staff of the Broken Hill Proprietary Co., Ltd.

**Herbert G. Moulton,** consulting mining engineer, after three years of Army service as a lieutenant colonel and colonel, has been appointed consulting engineer to Patiño Mines & Enterprises Consolidated, Inc., and its Canadian subsidiary, Patican Co., Ltd. He is a past president of the American Institute of Mining and Metallurgy and

HERBERT G. MOULTON

a member of the A.I.M.E., and has had extensive experience in mining and smelting investigations and research and finance, having been on the engineering staff of Eugene Meyer & Co., prominent in the development and financing of many copper-mining companies, prior to the first World War.

**P. G. Beckett,** vice president of the Phelps Dodge Corporation, retired from active service on May 1, after more than 41 years' service with Phelps Dodge. He will continue as a member of the board. Mr. Beckett is succeeded by **Harrison M. Lavender,** with the title of vice president and general manager, who will direct all Western operations of the corporation.

**"Art" Yates,** chief geologist of the International Nickel Co., has returned to Venezuela from the United States and has moved his field camp to the region of Tinaquillo, where a sampling campaign is already in progress.

## OBITUARIES

**C. A. Remington,** mill superintendent of the National Lead Co. MacIntyre development at Tahawus, N. Y., died on March 31, 1946, of coronary occlusion. Mr. Remington was born in Flint, Mich., in 1894, and graduated from the Michigan College of Mines in 1918. He

(*Continued on page* 142)

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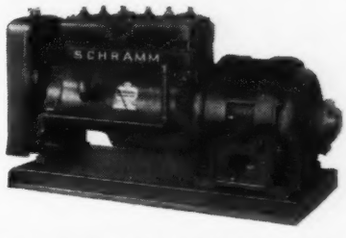


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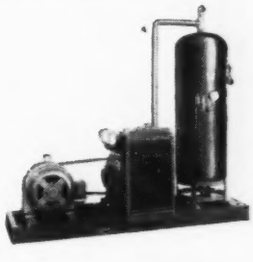

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# REGIONAL NEWS

## WASHINGTON

### Kaiser aluminum plant operation delayed—Mead magnesium property advertised for sale

★By an unpredicted order of the Securities Exchange Commission, Spokane brokers are forbidden to gather in a public place and make over-counter quotations on unlisted mining stocks. Some mining companies which have been on the over-counter list, but which are active traders, are applying for membership in the Standard Stock Exchange of Spokane. Other companies with stocks active in trading complain that the costs of securing and filing the necessary information for listing on the exchange are so heavy that they ought not to be required to make the expenditures.

★Three hundred employees of Northwest Magnesite Co., of Chewelah, have been granted an increase of 18½c an hour, which went into effect April 1. Contracts now in effect will be renewed for another year to expire July 31, 1947. Each employee received approximately $50 back pay. Earl A. Garber, executive vice president of the company, at Pittsburgh, and C. A. Sargent, manager at the plant, represented the company in the negotiations and Jack Gallagher represented the international union.

★The Mead magnesium plant, north of Spokane, is being advertised for sale or lease by the War Assets Corporation. Production of fertilizer is considered as one of its potential uses. The plant is being maintained with about 45 employees on a standby basis by Electro Metallurgical Co., which operated it during the war. It was designed to produce 48,000,000 lb. of magnesium and 48,000,000 lb. of ferrosilicon annually.

★D. A. Rhoades, Kaiser company executive, states that delay may be caused in starting production at two Kaiser operated aluminum plants at Spokane by the unexpected difficulty in obtaining the 4,000,000 lb. of copper needed to replace silver busbars and complete the installation of six pot lines at the Mead plant. It is understood that production may start on four lines.

★Capt. Wellman A. Clark, Therrett Towles, and Elmer E. Johnston, mining attorney members of Northwest Mining Association, met in March in Spokane to discuss provisions of the SEC act for assessable companies which prohibit preliminary inquiries but require mailing of a prospectus to persons not interested in the problem of raising capital for the development of the particular property. Mr. Johnston said that $300,000 exemption for non-assessable companies is another provision to which there is objection, for it includes provisions of the old Denison bill, several times defeated in Congress. This involves provisions of the old blue-sky law.

★Big Lake Mining Co., Will Everett president, has opened a new road connecting its property with the old Cuba mine in Ferry County. The Big Lake tunnel portal is 900 ft. above the Columbia River.

★Howe Sound Mining Co., operating the Holden mine, in the Cascades, in central Washington, paid a quarterly dividend of 30c.

★Taxes totaling $261,775 on personal property and stored products at the Mead and Trentwood aluminum plants were paid to Spokane County in March by the Aluminum Company of America, which operated the plants during the war. The taxes levied in 1945 for payment this year were $191,462 on the Trentwood plant and $70,312 on the plant at Mead.

★New Silver Bell Mining Co. has filed articles of incorporation, listing capital at $60,000. The property is in central Washington, near Almira.

★C. S. Thayer, plant manager for the Aluminum Company of America, at Vancouver, Wash., said in March, to newsmen touring the $15,000,000 plant, "The government is the only one with enough money to develop the Columbia power on any scale other than a piecemeal basis." He opposed any move to pattern the Columbia project on the Tennessee Valley Authority, however. The Vancouver plant is working at 150,000,000 lb. of aluminum a year capacity. The Aluminum company has had plans to increase this production capacity 60 percent by adding three production lines to the five now in operation. The present production at the plant is worth about $22,500,000 a year at the prevailing price of 15c a pound.

★The property of Chinto Mining Co., near Colville, has been acquired by Banner Mining Co. by a decree from Judge Ralph Foley in the Superior Court in Spokane. C. L. Miles and C. W. Genung, stockholders in the Chinto company, brought the suit to quiet title.

★The University of Washington offers four fellowships in the College of Mines for research in coal and non-metallics in cooperation with the U. S. Bureau of Mines. Fellows begin their duties on Monday, July 1, and continue for 12 months. Payments under a fellowship are made at the end of each month and amount to $1,140 a year. Applications will be passed upon in May.

The fellowships are open to graduates of universities and technical colleges who are qualified to undertake investigations of research character. Ordinarily the appointees register as graduate students and become candidates for the degree of master of science in mining, or metallurgical, or ceramic engineering. Normally the thesis can be completed and the degree obtained within the fellowship year. Occasionally an appointee registers for the bachelor of science degree in one of these curricula.

The purpose of these fellowships is to undertake the solution of various problems being studied by the U. S. Bureau of Mines that are of especial importance to the State of Washington, the Pacific Northwest, and Alaska. The work is performed in laboratory at the School of Mines.

## IDAHO

### New interest shown in district east of Mullan—Monitor group reports 1945 activities

★The Hecla Mining Co. has issued its annual report for 1945, showing a net income for the year of $1,399,092.68 and dividend disbursements of $1,000,000 during the same period. Hecla's largest operation during the past two years has been the Osburn tailings plant, which treated approximately 3,000 tons of low-grade material per day out of an old river bed deposit originally estimated to contain 3,000,000 tons. The Hecla mill, at Gem; the Polaris mill, at Osburn; Silver Crescent mill, on Moon Creek; and the sink-and-float plant and combination mill at Osburn treated the tailings-plant product.

Hecla also owns the controlling interest in the Polaris property, a portion of which, known as the "Omega" area, is being worked under a contract with Sunshine Mining Co. From this source Hecla received dividends totaling $379,350 during 1945.

★Hecla's largest mining operation in the Coeur d'Alene district is the Sullivan Mining Co., owned jointly with Bunker Hill. This operation includes the Sullivan zinc plant, at Kellogg, and the Star zinc-lead mine, at Burke. Operations of the Sullivan company in 1945 paid Hecla dividends of $250,000.

Other mining operations outside of the Coeur d'Alene district in which Hecla is wholly or partly engaged include the Blue Moon zinc mine, at

Hornitos, Calif., which netted the company a profit of $52,843.02 in 1945 and the Resurrection silver-lead-zinc mine, at Leadville, operated jointly by Hecla, Newmont, and United States Smelting Company. The property netted a joint profit of $164,416.56.

★Because of nation-wide labor strikes at A.S.&R. smelting plants, several mines in the Coeur d'Alene district have been storing their concentrates in the Hercules yards at Wallace. The mines include the Morning, at Mullan, and the Frisco, at Gem, owned by the A.S.&R. controlled Federal Mining & Smelting Co. The Page mine, at Kellogg, also a Federal property, is storing its concentrates at Kellogg. Mines treating their ores at the Bunker Hill smelter were not affected.

★Tamarack & Custer Consolidated Mining Co. has opened what is known as its Watson vein on the 3,400-ft. level, where it shows an orebody 6 ft. wide and which assays an average of 12 percent lead, 5 percent zinc, and 5 oz. silver per ton.

★The successful development of the Lucky Friday mine, just east of the town of Mullan, has opened extensive prospecting possibilities in a new silver-lead belt extending easterly from Mullan to the Montana State line. The belt is about 1,000 ft. wide in between two east-west major faults, which are locally known as the Osburn and White ledge. The Osburn fault is a wide tacky movement plane extending through the entire Coeur d'Alene district; the White ledge, on the north side of the newly discovered mineralized area, is a wide quartz dike with prominent outcrops. The ores in this belt are similar to the ores in the silver belt west of Wallace, and some geologists have expressed the opinion that the Osburn fault has shifted a part of this belt some 10 or 12 miles easterly.

The Lucky Friday Silver-Lead Mining Co. has successfully developed a silver vein to a depth of 1,000 ft., and the net smelter proceeds from the ore mined in this development have paid for the purchase price of the property, and all equipment and development work. The company has completed its shaft to the 1,400-ft. level, where it is preparing to crosscut to the vein.

This development has encouraged other mining companies to enter the field, including the Lucky Friday Extension, Hunter Creek, Vindicator, and Idaho Silver. The Lucky Friday Extension on the west end and the Hunter Creek, north and east, have made arrangements for development through the Lucky Friday shaft; and the Vindicator and Idaho Silver companies, both situated further east, have independent development operations.

★The Sunshine Mining Co. has acquired at 50-50 profit-sharing interest in the Aberdeen-Idaho group of 19 mining claims lying south and west of the Silver Syndicate vein, which Sunshine is now developing on the 3,700 level, 1,000 ft. below sea level. The


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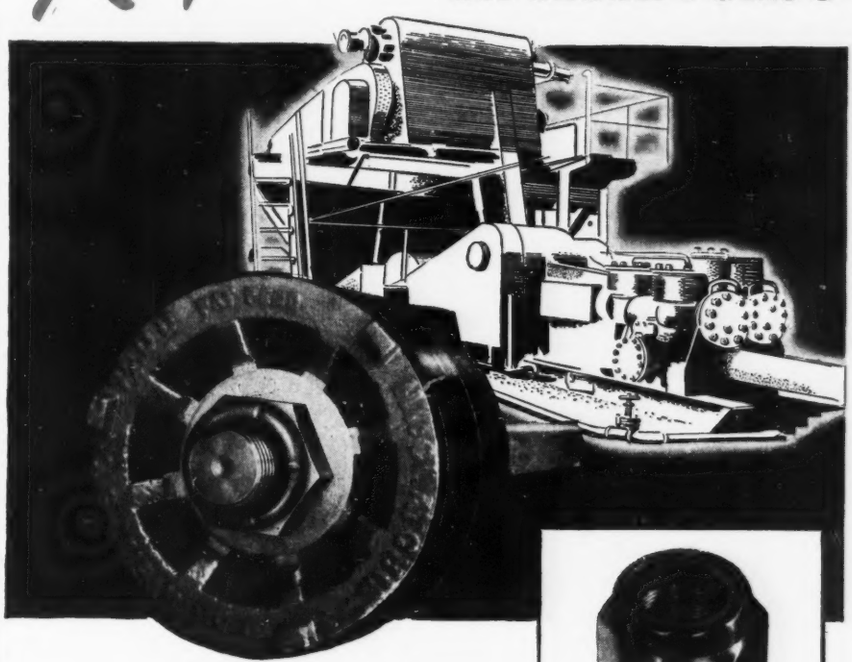

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## Idaho *(continued)*

profit-sharing agreement with the Aberdeen-Idaho is similar to contracts existing among the Sunshine and Polaris, Silver Dollar, Silver Syndicate, Sunshine Consolidated, Metropolitan, and Big Creek Apex Mining companies, all of which are accessible through Sunshine's deep workings.

★The Polaris Mining Co.'s net income for a 13-month period ending Dec. 31, 1945, amounted to $388,165.03, according to the annual report of L. E. Hanley, president of the company.

Polaris company owns about 2,200 ft. of ground on the Chester vein system, and its present income is derived entirely from a one-half interest in the profits from ore mined out of 750 ft. of the vein in the western end of the property and which is known as the "Omega" area; and from the "Rotbart" area, consisting of 400 ft. of ground in which the profits are one-third each to Polaris, Sunshine, and Silver Dollar mining companies. Polaris is independently developing its own ground easterly through the Silver Summit Mining Co.'s shaft, after having purchased 52.56 percent of the Silver Summit stock. Silver Summit's three-compartment shaft was down to the 1,500-ft. level, and Polaris is engaged in sinking on down to the 3,000-ft. level, which will be equivalent to Sunshine's 2,700 level. Polaris has also made a bargain with the Yakima-Shoshone Mining Co., owning an adjoining group of claims on the strike of the Chester vein, whereby Polaris will develop the Yakima-Shoshone group from the Silver Summit shaft on a 50-50 operating basis, or 50 percent of net returns on ore produced.

★The Nevada-Stewart Mining Co., on Pine Creek, is driving a 2½-compartment raise from the No. 3 tunnel level to the surface in preparation for stoping operations on an orebody recently opened. Where encountered and drifted on for a short distance, the vein shows a width of milling ore 12 ft. wide. The company recently installed a new air compressor underground and is preparing a shaft-development program.

★The Monitor Mining Co., operating a large group of small zinc-lead mines in the Beaver district north of Wallace, reports a loss of $68,579.84 for 1945. The company operate six producing mines—namely, the Amazon, which produced for the year 43,369 tons; the Carlisle, 21,644 tons; Silver Tip, 4,192 tons; Parrott, 6,761 tons; Idora, 1,277 tons; and Nipsic, 2,716 tons. The combined production from these ores included 9,652,460 lb. of zinc, 3,976,700 lb. lead, and 77,182 oz. of silver. Profitable operation of these properties would be impossible, states Henry L. Day, manager, without the present over-all price for lead and zinc. The ore is treated partly at a company mill in the district and at the Hercules mill in Wallace. The district is an isolated section in a deep snow country requiring truck haulage of both concentrates and crude ore over a high mountain range. The company has recently purchased the old Interstate-Callahan mine, at the head of Nine Mile Canyon near Wallace, and is driving a main haulage tunnel through from the Carlisle workings to connect with deep levels in the Interstate-Callahan, which will give the Monitor a much shorter outlet to railhead and will at the same time prospect at greater depth the old Callahan property, which was a large zinc producer at the time of the first World War.

★The Hope Silver-Lead Mining Co. at Clarksfork, Idaho, is sinking a 2½-compartment vertical shaft to a depth of 750 ft. to open what is known as the Pearl vein, located by Government diamond drilling. The shaft is now down 590 ft. The Hope company is equipped with a 150-ton flotation mill and has been producing silver-lead ore from the Hope vein, a smaller and parallel structure to the Pearl vein, which latter has been highly productive in Congressman Compton I. White's adjoining Whitedelf mine.

★The Callahan Consolidated Mining Co. shows a net operating profit of $32,658.91 for 1945, according to the company's annual report. Donald A. Callahan, president of the company, states that all production is coming from above the 700-ft. level because diamond-drill operations below that level proved discouraging. The company has recently discovered ore on the 300-ft. level of the mine, which has raised content of lead and zinc in the mill feed. The new orebody is a continuation of the old Rex vein in both east and west directions from ground formerly operated by an early company. The drift of the new orebody is 12 ft. wide, all of which is a good grade of milling ore.

★The annual report of the Clayton Silver Mining Co., operating at Clayton, Idaho, shows a net profit of $24,350 for 1945. Since 1935, the Clayton mine has produced 22,000,000 lb. of lead, more than 1,200,000 oz. of silver, and smaller amounts of gold, copper, and zinc. The company has recently employed Byron Wilson, formerly with the Hecla company, as general manager and Norman Smith, of the Sunshine, head geologist. The mine adjoins the Red Bird property, owned by the Ford Motor Co.

★The Douglas Mining Co., on Pine Creek, which is operated under lease to the Small Leasing Co., reports receipts of $70,637.45 in royalty payments of ore produced up to March 1, 1946. The company has extended the Small Lease from Dec. 31, 1945, to Dec. 31, 1946. The Douglas company has purchased three adjoining claims and is doing the patent work on two of them. Stanly A. Easton, president of Bunker Hill, is president of the Douglas company. The property is equipped with a modern 150-ton flotation mill.

★Harry P. Pearson, of Wallace, has organized a company and taken over the Silver Ridge Mining Co. property near Sandon, B. C. Active mining operations will begin as soon as snow conditions permit.

★The Silver Dollar Mining Co.'s shaft has reached to 3,000-ft. level, equivalent to the 2,700 level in Sunshine, and is cutting ore and waste pockets and a large station in preparation to driving a crosscut south to the "Chester" vein system, which has been productive further west. Silver Dollar also controls the adjoining Silver Chieftain group of claims on the same vein, and which will be prospected through the new shaft. Silver Dollar has produced and shipped a large tonnage of silver ore from this vein on higher levels, but on the 1,900 level the vein was badly disturbed and contained no workable tonnage of ore.

# CALIFORNIA

### Central Eureka outlines mining plans—Natomas dredging operations are expanding

★Development work continues and actual production is expected to start in a few weeks at the Oro gold property at Downieville, Sierra County, operated by Associated Metals, Inc., of Seattle, Wash. Plans include installation of a new milling plant to replace the old unit now available. J. T. Bonner is resident engineer directing operations, and Angus James, foreman.

★Installation of a cyanide plant is nearing completion at the Ancho Erie mine, near Washington, Nevada County, and development on the Ancho vein continues. Prior to the appointment of C. C. Cushwa as superintendent the property was managed by Fred Anderson, general manager of the company, who is reported to have purchased the Columbia Consolidated Mines properties on Canyon Creek two miles east of Washington. C. A. Helbach, of Grass Valley, is president of the company, which is backed by the Fleischhacker interests, of San Francisco.

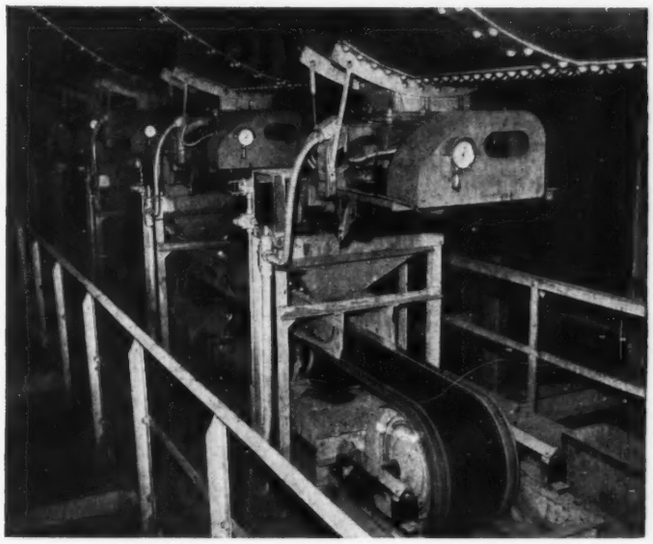
★C. C. Prior, president, Central Eureka Mining Co., in a letter to stockholders has outlined a plan for future operation of the company's gold property in Sutter Creek, Amador County, involving dewatering the Central Eureka shaft and connecting it with the Old Eureka shaft on the 3,500 and 4,000 levels, and driving a drift from the Old Eureka to the north orebody on the 4,000 level. The program would cost about $450,000, but this sum may be considerably reduced in the event that production is resumed earlier than expected, or that ore should be found in the connection drift. With improving labor supply, rehabilitation work now in progress at the mine should be speeded up materially. More effi-

cient operation than heretofore will be necessary to reach the orebody developed below the 3,500 level, Mr. Prior stated, and to make this possible stockholders, numbering some 1,500, should be prepared to pay three assessments of 25c. each before profitable mining is under way. Two assessments of 10c. each have been levied thus far, as a result of the 3½-year shutdown which depleted the company's $472,724 cash reserve at the time of the war shutdown in 1942. Net loss for 1945 is reported at $149,047.

★Natomas company reports a net income of $623,478 for 1945, compared with $532,128 for 1944. Owing to book loss on land sale contracts in the amount of $556,362, net income from all sources amounted to only $67,115. A dividend of 60c. a share was paid in December 1945, totaling $553,260. Gross returns from gold dredging operations in 1945 amounted to $1,052,124. Operating expenses, royalty payments, depreciation, and depletion amounted to $663,575, leaving an income of $388,548. The company operated two dredges throughout the war with WPB permit, and normal activities were reached by the end of 1945 after placing three units in operation soon after L-208 was rescinded in July 1945. A sixth dredge started operation in the Folsom field in January 1946. The remaining unit will be placed in operation as soon as parts taken from it during the war to keep others in working condition can be replaced. The company also has a substantial interest in the Manhattan Gold Dredging Co., active near Tonopah, Nevada; owns a 50 percent interest in the South Platte Dredging Co., Fairplay, Colo., and has interests in the Merced Dredging Co., San Joaquin Mining Co., and South American Gold & Platinum Co. A dragline dredge is being prepared for operation on the Greenan placers, near Battle Mountain, Nev., and present plans include remodeling one of the seven dredges in the Folsom field for eventual operation some time during 1947.

★Placer and lode mining activities are increasing steadily in Siskiyou County. Ed McBroom has started hydraulic operations at the Farnsworth mine, on the South Fork of the Salmon River, and Price Mining Co. is doing development work at its property situated between the Eliza and Boyle mines 14 miles west of Yreka. Marah Mining Co., C. W. Yates, manager, plans early installation of a 35-ton mill at its gold mine on the Klamath River near Yreka. Erection of a surface plant and mill is reported under way at the Nebraska gold property on Cherry Creek, 10 miles west of Yreka, operated by L. G. Severns, Santa Rosa contractor; and A. C. Crawford has installed a dragline dredge on placer ground below Sawyers Bar. Also active in the Sawyers Bar area are the old Joubert hydraulic mine, and Midland Mining Co., working placer holdings with a suction dredge.

★Red Cloud Mines, Inc., a subsidiary

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## California *(continued)*

of Hecla Mining Co., ceased operations some time ago at the Blue Moon mine, near Hornitos, Mariposa County, following caving of underground workings, and machinery and equipment have been dismantled and removed. Robert Dunn is superintendent.

★Idaho Maryland Mines Corporation, Grass Valley, Nevada County, reported for 1945 a net profit of $19,618, after all charges, equal to 1c. a share on 1,179,837 shares of capital stock outstanding, compared to a net loss of $127,270 in 1944. Ore production amounted to 65,524 tons. In comparison, 263,768 tons were produced in 1941. The gross value of the company's production in 1945 was $728,013, of which $114,806 was derived from milling plants clean-up. Tailing losses on the 66,034 tons of ore milled was $31,814, giving a gross mine ore head value of $645,021, or $9.77 per ton. Tailings losses were 48c per ton, giving a recovered value of $9.29 per ton. A total of 20,690 oz. gold and 5,519.17 oz. silver were recovered.

## MONTANA

### Butte strike settlement grants wage increases, closed shop; sets up grievance machinery

★The ten-day strike at Butte was officially ended on April 19 with the signing of a contract between Miners' Union No. 1 and the Anaconda Copper Mining Co. which grants a wage increase of 18½c. an hour and retroactive pay of 9¼c. an hour from Oct. 1, 1945. The agreement automatically renews itself from year to year unless notice of desired changes is given by either party. A summary of the principal provisions follows:

The company agrees to retain in its employ as miners only union members in good standing, and to deduct from wages monthly dues, initiation fees, and international assessments.

The union agrees that there shall be no collective cessation of work, and the company that there shall be no lockouts, on account of any controversy unless all means of settlement under the contract's provisions shall have failed. The company retains the right to extend, limit, or shut down operations.

Double time will be paid for Memorial Day, Fourth of July, Labor Day, Christmas Day, and July 13th, "Miners' Union Day." Hours of work in excess of 8 per day or 40 per week will be paid for at time and a half rate. The company will contribute an amount, not over $1 per family per month, equal to the amount paid by employees for family medical contracts.

Grievances which cannot be settled on the job must first be taken up by the employee, or representatives of his choosing, with the management. A Mine Grievance Committee, consisting of one man on each operating level of the Mountain Con, Belmont, Leonard, and Tramway mines, will be recognized by the company to represent employees. Failing settlement by this means, grievances will be referred to a committee representing the union and a committee of the company. Final adjudication may be made by an Executive Industrial Relations Committee, consisting of three employee and three company members. In the event of failure of four members of this committee to agree, the union and the company will mutually agree upon an arbitrator, whose decision shall be final. Either party may also appeal to U. S. Government mediation channels.

Vacation periods of seven and fourteen days will be allowed employees having less or more than five years of service respectively, with pay applying to the number of days per week normally worked by the employee concerned.

Provision is made for company payment of union members while serving in official capacities at union conferences or committee meetings, or as delegates to union conventions.

The company agrees to continue its policy of giving hiring preference to former employees and local applicants, but will comply with federal and state laws pertaining to reemployment of men inducted into the armed services.

The wage increase of 18½c. and retroactive pay of 9¼c., subject to approval of the Director of Economic Stabilization, shall continue during the term of the contract so long as existing price quotas, premiums, and subsidies remain in effect.

## ARIZONA

### Chloride Mining Co. will manage Emerald Isle — USES reports mining labor still short

★A recent U. S. Employment Service report indicates that more than 900 mining jobs are open in the State of Arizona. This situation exists despite the strikes that have tied up most of the mining operations in the area.

★Charles H. Dunning, director of the Arizona Department of Mineral Resources, recently declared that premium price payments on copper, lead, and zinc are almost certain to continue beyond June 30, when the present law expires. Mine owners throughout the State assert they will be unable to continue operations beyond that date unless the premiums continue or higher prices are allowed.

★Two new large diesel-driven air compressors have been installed in the Summit mine, in the Kingman district. Each compressor is of 315 c.f.m. ca-

pacity and is driven by a 135-hp. diesel motor. A large air receiver has also been installed, thus providing the Summit-Alpha mines with modern, efficient air power. This will make possible an increase in production to 60 to 80 tons of ore per day.

★Subjects vital to small-mine operators in Arizona were discussed at a meeting of the Yavapai council of Arizona Small Mine Operators last month. J. P. Zannaras opposed ownership transfer of the public domain from federal to state control. He asserted the transfer would jeopardize mining because of the great difference in the cost of leasing the property.

At the same meeting J. Walters, Jr., head of the Cedar Talisman Consolidated Co., gave a brief talk on the progress of operations at the French Lilly mine, at Cleator.

★Application for mining patents on 120 acres of forest land in the Catalina Mountains by Randolph Jenks was refused last month. The forester of the area declared the area under consideration was of no mining value and was more valuable as a national forest.

★Management of the Emerald Isle Copper Co. has been taken over by the Chloride Mining Co. under the terms of an agreement reached by officials of the two companies. R. J. Payne, manager for the Chloride company, has assumed charge of operations at Emerald Isle.

The Emerald Isle property, near Chloride, produced until recently. The ore is mined both from underground workings and from a large blanket deposit near the surface. Copper concentrates are shipped to the Clarkdale smelter.

★The Music Mountain property, in Mohave County, has been acquired by Leo Manson under a contract negotiated with Leonard and Claude Neal, former owners, on April 1. Mining equipment has been moved to the property. Present plans are reported to include erection of a mill.

## UTAH

### Federal fact-finding board fails in strike mediation — Chief Cons. reports 1945 loss

★By a four-to-three decision, the United States Supreme Court ruled on March 25 that federal courts are without jurisdiction to hear a case brought by Kennecott Copper Corporation and Silver King Coalition Mines Co. against the Utah State Tax Commission to recover a total of $42,347 in mine occupation taxes based on 1943 federal subsidy payments. The decision upheld one made July 23, 1945, by the Tenth Circuit Court of Appeals in Denver, and reversed an earlier decision by the Federal District Court at Salt Lake City. C. C. Parsons, attorney for Kennecott, said his company will file suit soon in the Third Utah District Court for recovery of the mine occupation tax overpayment. Eleven other Utah metal-mining companies which filed similar suits earlier in Utah district courts are awaiting decision by the State Supreme Court, following appeal by the State Tax Commission from state district court decisions favoring the mining companies.

Mr. Parsons pointed out that the March 25 decision does not affect a case brought by his company against Salt Lake County, asking return of net proceeds taxes based upon Federal subsidies. Decision on this case still is pending before the Tenth Circuit Court of Appeals, at Denver.

★Attempts by a federal fact-finding board to settle the strike involving 5,000 Utah employees of the Utah Copper Co., United States Smelting, Mining & Refining Co., and American Smelting & Refining Co. failed as of April 6, according to a report by Dan Edwards, district No. 2 representative, International Union of Mine, Mill & Smelter Workers (CIO), and Willard Y. Morris, union attorney. The hearing had been conducted in Denver by a three-member federal board including James H. Wolfe, justice of the Utah State Supreme Court; Chairman George E. Strong, Washington, D. C., attorney; and Dr. Carl Borgman, head of the chemical engineering department, University of Colorado.

Meantime, Herbert B. Maw, Governor of Utah, said on March 30 that a state fact-finding board would be appointed if the federal board failed to mediate the strike. Governor Maw cited figures compiled by the State Tax Commission to the effect that the strike, which began on Jan. 21, already had cost the state $365,000 in taxes. "In addition," the Governor said, "hundreds of thousands of dollars have been lost to businesses in the involved area; more than $200,000 has been paid in unemployment compensation to strike-involved employes (principally A. F. of L), and large and increasing sums are being paid in state relief." If the strike continues until Utah Copper Co. shows a loss for the year, Salt Lake County and Jordan School District would lose their largest single property tax income source. Valuation of Utah Copper Co. property for tax purposes in 1945 was more than $80,000,000.

★F. S. Mulock, vice president and general manager of western operations, U. S. Smelting, Refining & Mining Co., said the federal fact-finding board would hear arguments April 18 in Washington, D. C., and was expected to issue a report no sooner than May 1. Mr. Mulock said union representatives, meanwhile, decline to negotiate, pending the report by the federal fact-finding committee.

Mr. Mulock on March 30 announced retirement of two veteran employees of his company: John R. (Russ) Henderson, purchasing agent, who retired April 1 after more than 22 years of service; John Whittle, roaster foreman at the Midvale smelter. Mr. Whittle first was employed by the company at Midvale in October, 1907.

★Three cash awards totaling $1,000 are offered by Eimco Corporation for original manuscripts dealing with mechanical loading, other than scrapers, in hard-rock mining. The competition is open to anyone enrolled during 1946 as a senior or graduate student and who is a candidate for the degree of engineer of mines, bachelor of science, master of science, or a doctor's degree in the department of mining engineering at any accredited mining school in United States or Canada. Manuscripts are to be mailed to the Eimco Corporation, Dept. S, P. O. Box 300, Salt Lake City 8, and must be postmarked on or before Jan. 1, 1947. Entries must be in normal thesis form. Judges, to be selected from among qualified mining men and faculties of mining schools, will award prizes of $500, $300, and $200. David W. Saunders, Eimco sales promotion manager, said the purpose is to gather information on mechanical loading from unbiased sources.

★Plans for organization of the Utah Geological Society and for its first field trip to be made May 10 to 12 to the Henry Mountains of southern Utah are announced by a committee for organization consisting of J. A. Marsh, consulting geologist; G. C. Selfridge, professor of geology, University of Utah; A. E. Granger, assistant regional director, U. S. Geological Survey; and Orlo Childs, geologist, Sinclair-Wyoming Oil Co., all of Salt Lake City. C. B. Hunt will be guide for the first field trip.

★Operating profit for Ohio Copper Co., of Utah, in 1945 was $147,068, compared with $91,055 in 1944, Percy H. Kittle, president, announced. The company treats tailings and leachings from old mine slopes at Lark and operates the Big Indian mine, in the LaSal district.

★Manpower shortage at Park Utah Consolidated Mines Co., Park City, accounted principally for a decline in tonnage mined and profits in 1945, Paul H. Hunt, vice president and general manager, reports.

Figures from the annual report follow:

| | 1945 |
|---|---|
| Tons mined | 27,893 |
| Gold, oz. | 683 |
| Silver, oz | 315,188 |
| Lead, lbs. | 6,486,316 |
| Zinc, lbs. | 5,590,890 |
| Copper, lbs. | 157,423 |

★Iron-ore production in Utah continued a downward trend in January, U. S. Bureau of Mines figures show, totaling only 61,369 tons compared with 107,516 tons in December, 1945.

★The nation soon must recognize that reconversion may be seriously affected if promotion of unsound economic theories is permitted to continue to restrict non-ferrous metal production, said E. H. Snyder, president, Utah

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## Utah *(continued)*

Metal Mine Operators' Association, in a communication issued April 5. He described modification of the premium price plan for non-ferrous metals to offset prospective wage increases as "a makeshift and an unsound procedure at the expense of the taxpayers to control the profits of the industry. In many cases metal consumers would prefer to pay higher prices in order to obtain an adequate supply," he said further.

★Chief Consolidated Mining Co., Eureka, suffered a net operating loss of $37,365 in 1945, compared with a net profit of $152,395 in 1944, according to the annual report issued by Cecil Fitch, general manager. Shaft repair work in 1945 reduced production working days to five, compared with six in 1944.

Production figures for 1945 follow:

| | |
|---|---|
| Tons of ore | 75,109 |
| Average gross value per ton | $23.19 |
| Zinc, lb. | 7,713,760 |
| Lead, lb. | 4,305,951 |
| Copper, lb. | 2,033 |
| Gold, oz. | 1,244 |
| Silver, oz. | 301,959 |

# NEVADA

### U. S. Vanadium to use part of Basic Magnesium plant — Elko County mineral survey resumed

★U. S. Vanadium Corporation has entered into contracts with federal agencies for the use of certain metal units of the Basic Magnesium, Inc., plant at Henderson, and by July 1 will be operating at full scale, processing tungsten concentrate from its primary treatment plants in Nevada and California, according to a report by J. Ray Coulter, in charge of preliminary work for U. S. Vanadium. Major supply will come for the present from the enlarged 500-ton flotation concentrator at the Riley mine, in the Potosi district, Humboldt County, lately purchased, from which concentrate is being delivered by trucks to the Basic plant. It is the announced purpose to centralize initial chemical treatment of concentrate from all company plants, as well as custom products, at the Henderson plant, providing a market for the product of small operators throughout the mining states. The operation, Coulter indicated, will consume quantities of chemicals produced by the Hardesty Chemical Co. and Stauffer Chemical Co., lessees of other units and buildings of the huge Basic installation.

★Standard Cyaniding Co., closed down by Order L-208 when treating 700 tons per day of $2.20 open-cut gold ore near Rye Patch, Pershing County, has been "set back" at least three months in its plan for capacity operation, the halt being attributed to strikes that have prevented delivery of equipment to the Western-Knapp Engineering Co., which built the highly efficient plant and is providing new units and replacing others released during the war period to strategic metal mines. Harold L. Hazen, metallurgist, is president-manager and Henry Bradley is vice president and consulting engineer, with offices at Lovelock.

★A comprehensive survey, with sampling of accessible mine workings, in the formerly productive Tuscarora gold-silver district, northwestern Elko County, interrupted by heavy snow in February, has been resumed by engineers and crews in the employ of the Utah Construction Co., lately awarded a Government contract for construction of the Davis dam, below Boulder dam, on the Colorado River. Long-term options on the historic Dexter, Navajo, Tuscarora, and adjacent placer mines, among the first to produce in Nevada, were assigned to the Utah Construction Co. by A. Blake Thomas, manager for the Siérra Nevada, Ltd., with mines and mill on the Comstock lode, and head office in the Stock Exchange building, Salt Lake City. Options include more than 75 claims, embracing mines with recorded production of some $20,000,000, but not opened at appreciable depth, because of the lack of pumping equipment in early-day operations.

★Additions to the cyanide mill of the Consolidated Chollar, Gould & Savage Mining Co. at Gold Hill, on the Comstock lode, south of Virginia City, were said to have increased substantially the capacity of the plant, treating around 400 tons prior to L-208. Ore is mined from a nearby open cut on the lode outcrop and delivered to the crusher bins by contract. F. V. Dempsey, of Virginia City, is superintendent; E. C. Maroon, mill superintendent; and Thomas V. Barton, Kohl Building, San Francisco, managing director.

★Control of the Rio Grande Copper Co., with large property holdings in the Cope or Mountain City district, in northern Elko County, adjoining the Anaconda-operated Rio Tinto mine of the Mountain City Copper Co., and claims of the Mountain City Consolidated Copper Co., has been acquired by a group of midwestern industrial leaders, with purchase of 250,000 shares of treasury stock for $150,000 and an option on 260,000 shares, largely holdings of company officers, at $1 per share. The transaction was announced by John E. Robbins, Elko attorney and secretary of the Rio Grande company. Extensive diamond drilling has been conducted on the property by the U. S. Bureau of Mines.

★New activity in gold lode and placer mining is notable in the adjacent Varyville and Leonard Creek districts, in western Humboldt County. The Eureka Humboldt Mining Co., Lauren S. Fish president-manager, operating a gravel-washing plant before the war, has acquired additional placer claims and water rights and has increased its plant capacity. The Juanita Mining Co., Paul

Soule, of Salt Lake City, manager, has equipped and is developing lode claims bought from Josie Pearl, pioneer woman prospector of the area. An association of Fallon miners has started active work on partly developed claims at nearby Columbia, site of early-day Indian raids.

★Cordero Mining Co., operating in northern Humboldt County and one of the foremost U. S. mercury producers, reports 1945 production of 17,229 tons of cinnabar, with quicksilver recovery having a net value of $221,025.95, on which bullion tax was paid, and gross value of $480,484 for the year's production.

★The old Silver Palace silver-lead-zinc mine, at Grantsville, northern Nye County, has been equipped with a new flotation mill, according to a report by officers of the Associated Mines Corporation of California, latest of many organizations to operate the mine. Old workings are being unwatered. The mine produced prior to 1890.

★Tungsten ore purchased during the war by the Metals Reserve Co. and stockpiled at Battle Mountain and Winnemucca, on the Southern Pacific main line, aggregating several thousand tons, has been trucked to the concentrator at the Getchell mine, in the Potosi district, which has been treating 600 tons of scheelite from the nearby stockpile mined in that district.

★With lead-zinc-silver property near Pioche operated under lease by the Combined Metals Reduction Co., the Raymond Ely West Mining Co. reported cash balance Jan. 1, 1945, of $253,450, with receipts for the year of $777,620, expenditures $693,664, including $51,575 in taxes, and balance of $337,406 at the year's end.

★A high recovery of pure cobalt metal has been made at the Boulder City test plant of the U. S. Bureau of Mines from oxidized cobalt ore of the Goodsprings district, in Clark County, a recent bulletin reveals. Some of this ore was shipped to test plants during the first World War, but no production is recorded.

★A contract has been awarded for prospect drilling and reopening of old workings of the gold property of the Marigold Mines, Inc., six miles south of Valmy, in southeastern Humboldt County. Equipment for a 200-ton cyanide plant was being assembled and ore was being shipped at the rate of over 200 tons monthly when work was halted by L-208. The company was headed by the late Frank E. Horton.

★Eureka Corporation, Ltd., subsidiary of Ventures, Ltd., of Toronto, is making notable progress in sinking its four-compartment shaft on its Richmond-Eureka property, on Ruby Hill, near Eureka. Connection will soon be made with a crosscut driven from the 900-ft. level of the old Locan shaft, some 1,300 ft. to the south. William Sharp is superintendent at Eureka.

DFC Laboratory Crushers make short work of reducing tough quartz or soft rock to 4 mesh or finer at the rate of 50 to 150 lbs. per hour.

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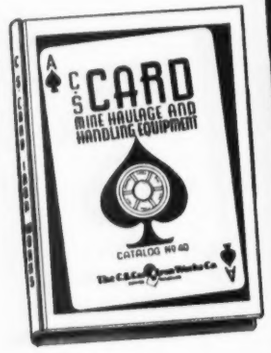


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## COLORADO

### Cripple Creek properties are sampled by power shovel — Dredges active at Fairplay

★Mines, Inc., a recently organized Delaware corporation, is conducting a large experimental sampling project on Globe and Iron Hills, in the Cripple Creek district. Samples are being taken from the Stratton and Cavanaugh properties, and from the sides of hills rather than from existing mines. Power shovels and trucks are being used, and a sampling plant capable of handling 10 tons of rock and dirt an hour has been built at the site of the old Cripple Creek mill, on Globe Hill. W. H. Bergin and C. G. Rose are in charge. Both are Missouri School of Mines graduates recently returned from military service.

★Lupton Mines Co., of Georgetown, headed by Major Ellis P. Lupton, has recently bought several producing properties to feed the Commonwealth mill, below Georgetown, which the company purchased last fall. The company has acquired the Grizzly Gulch mine, near Silver Plume, from O. Barlow Willmarth, who retains his other properties in the district. Lupton Mines Co. has also bought the Kelly tunnels and the Boston-Beecher properties from E. P. Moe, of Breckenridge. The company's first purchase was the Stevens mine, southwest of Silver Plume, in the spring of 1945.

★Golden Cycle Corporation had a consolidated net loss of $19,663 for 1945, compared to one of $16,957 in 1944, Merrill E. Shoup, president, has reported to stockholders. Sales and revenues totaled $3,261,285 in 1945, compared with $3,844,113 in 1944. Both compare with an average normal figure of about $6,200,000. President Shoup stated that the use of large quantities of dump ore held 1945 values down, and that labor and materials became only slowly available. The Cresson mine, largest Cripple Creek producer, reopened on schedule on April 1. Also, Mr. Shoup reported that ore in the Ajax, made accessible by the Carlton tunnel drainage, and already blocked out, is expected to provide at least $2,000,000 in metal values. United Gold Mines Co., another of the Golden Cycle group, reduced its net loss from $16,792.02 for 1944 to $407.56 for 1945, Mr. Shoup reported.

★U. S. Vanadium Corporation has signed a contract with its mine and mill employees providing an hourly increase of 15c. The contract will expire on Feb. 25, 1947. Meanwhile, American Smelting & Refining Co. has published formal notice to its Leadville employees, about two-thirds of whom were laid off when the strike began, that work is now waiting for them, "upon the same terms and conditions as existed at the time of the temporary shutdown for lack of ore on Feb. 1, 1946." The Colorado Industrial Commission has ruled that unemployment compensation may be paid to employees who were laid off at that time, but not to those who were still employed at the time they struck.

★Colorado School of Mines is becoming so crowded that Ben H. Parker, president, has announced a system of priorities for acceptance of applicants. Present and former students with acceptable records will have first priority; second, veterans who are residents of Colorado; third, non-veteran Colorado residents; fourth, veteran non-residents; and fifth, non-veteran non-residents.

★Receipts of gold and silver at the Denver Mint continue to increase. During March the mint received 26,029 oz. of gold plus, valued at $912,434.42, compared with receipts in March, 1945, of 14,452 oz. plus, valued at $505,821.63. In March 1946 8,687 oz. of silver were received, compared to 3,431 oz. in March 1945. All silver was mixed with the gold, no pure silver shipments being received. The Denver Mint's total fine gold stocks now amount to more than $5,000,000,000.

★Edward Cooper will resume dredging operations on the French Creek holdings, near Breckenridge, with a boat which will handle more than 2,250 cu. yd. of gravel a day. Timberline Dredging Co. will open up two more placer operations near Fairplay, the Beaver Creek dredge and the Snow Storm dragline. Cooley Bros. there plan placer operations at Como. Natomas Dredging Co., of California, plans to build a new dredge at Breckenridge. Its dredge, operated near Fairplay by South Platte Dredging Co., has been working three shifts daily since the revocation of Order L-208.

★Idarado Mining Co. has purchased the Bates hospital, at Ouray, and will operate it as a community as well as a company hospital, with Dr. E. L. Spangler in charge.

★J. E. Bennett is building a mill at Montezuma to process silver-lead ore from the Chataqua mine, on Teller Mountain, which he has been developing for two years.

★Reginald Moore, of Idaho Springs, has organized a company to operate the Malachite mine, on Genessee Mountain, a tunnel property with copper, gold, and silver values.

★H. D. Tudor, president of Sonoma Quicksilver Mines, Inc., at Guerneville, Calif., and Colorado Fluorspar Mines, Inc., of Salida, announces the purchase of the Carter mine, near Ohio City. Mr. Tudor will head the new company, which will be named Carter Mines, Inc.

The Carter mine, in Gunnison County, formerly produced gold, having operated almost continuously since 1900 until the government closing order.

Work has been started by the new company to rehabilitate the mine and install a 6x6 ball mill to replace the present stamp mill.

S. F. Wickham, general superintendent of Colorado Fluorspar Mines, Inc., will act in the same capacity for the new company. R. O. Bellsmith will be in charge at the property.

## TRI-STATE

### Eagle-Picher asks NWSB approval of $1 a day wage increase — Federal workers seek 30 percent

★Efforts of Tri-State operators to obtain approval of wage increases through the National Wage Stabilization Board, and under the new Office of Price Administration set-up of premium quota adjustments, vied with the efforts of organized labor to expand its membership activities in the zinc-lead mining field during the latter part of March and the early part of April. The day following the official release on March 28 by Chester Bowles, director of the Office of Economic Stabilization, which provided that cost increases resulting from wage adjustments in metal mining and smelting would be covered through increased subsidy payments instead of allowing increased ceiling prices for zinc, lead and copper, the Eagle-Picher Mining & Smelting Co. filed through the Kansas City office of NWSB an application for approval of $1-a-day increase to 1,212 hourly paid employees of the company.

Notices of the filing for the dollar hike in the daily wage, which would bring the employee's rate of pay to the highest level in the history of the field, were posted April 4 at company properties in the district. It was pointed out at the time that for an employee now earning $7 a day, the dollar increase would, under the present work week of 48 hours, allowing time and one-half for work in excess of 40 hours, bring his take-home pay to $52 a week.

A week after posting of the notices, Reid Robinson, national vice president of the C.I.O., who heads the International Union of Mine, Mill and Smelter Workers, addressed an organizational rally in Picher under the auspices of the Eagle-Picher workers' organizing committee, which was attended by nearly 500 miners and millmen. He advocated an increase of 18½c. an hour in the standard base rate in miners' pay in the Tri-State area and a 40-hour week, which on the basis of the employee earning $7 a day would amount to an increase of $1.48 a day, or a total take-home pay of $42.40. Howard Lee, another representative of the union, announced that the organization committee had petitioned for an election among Eagle-Picher Central Mill and other surface property employees, the date for which had not then been set. Lee also declared that, with organization of the key properties, efforts would be made to organize the underground workers of Eagle-Picher.

★The dissatisfaction of labor with pre-


# How Long Should an Apron Feeder Last?. . . . . .

The apron feeder has greatly increased the efficiency and helped to increase the life of crushing and pulverizing equipment by feeding material at a constant tonnage rate. When material is dumped directly into the crusher, the unit is overloaded for a brief period, and a short time later the crusher may be running idle. Prior to the introduction of apron feeders, efforts to obtain uniform feed were not successful.

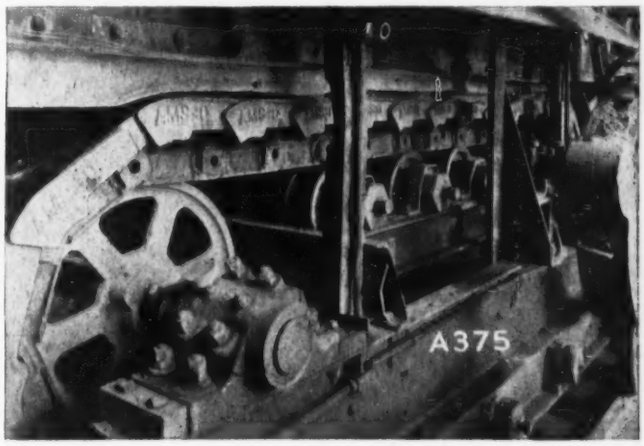
When apron feeders were first used in metal mines and rock quarries, the destructive effect of heavy, repeated shocks and grinding abrasion on pans, links and rollers made apparent the need for better design and material for this equipment.

The Amsco-Brayton Apron Feeder, combining the Brayton design with austenitic manganese steel for the parts which must withstand stresses and abrasive wear, has proved highly successful as its installations, not only in the United States, but also in Alaska, Canada, South America and elsewhere throughout the world, have demonstrated. The number of these feeders in the Southwestern states alone runs well into three figures.

Amsco feeders have at times taken severe punishment, but we do not encourage the practice of dumping carloads of ore onto the empty pans. While it is true that manganese steel will stand a lot of this sort of abuse, even "the toughest steel known" will yield in time. If you treat your Amsco-Brayton Apron Feeder right, it will treat you right — in terms of long, economical service.

It is also a fact that no Amsco-Brayton Apron Feeder has worn out and been replaced as an operating unit since the first installation 24 years ago; and none has been replaced by a feeder of another make.

Although occasional replacement of one or another part has been necessary, we still don't have the answer to the query: "How Long Should an Apron Feeder Last?"




*A-375. One of two Amsco-Brayton Apron Feeders which handled 10,000,000 tons of ore in seven years in a Mexican silver mining operation.*

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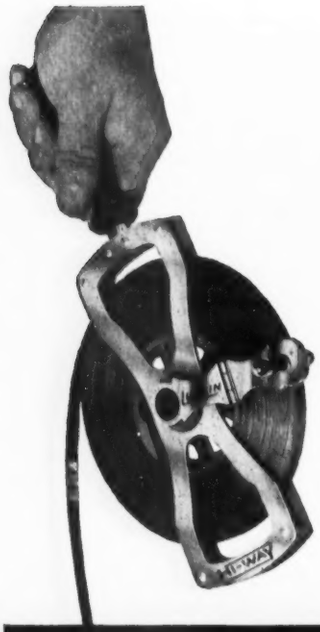


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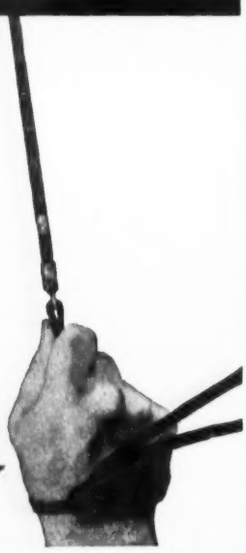

LUFKIN FOR ACCURACY

## Tri-State *(continued)*

vailing wages in the wake of the inflationary cost of living broke out during the Ides of March week, when union employees of the Federal Mining & Smelting Co. went on strike at the Duenweg properties of the company, east of Joplin. The walk-out subsequently spread to other company operations at Granby, Mo., and at Picher. Settlement of the strike, which lasted a week, was effected on March 20, at a conference between management and labor, participated in by Claude Hauley, of the Kansas City regional office of the Conciliation Service. Following the settlement of the dispute over discharge of a shop steward that resulted in some 300 miners striking, a representative of the International (CIO) union announced that "negotiations over wages are to be opened within 30 days," with the union asking for a 30 percent wage increase. The Federal properties affected by the strike included, besides the Duenweg mill and mines, the mines and mill at Granby and the Gordon, Lucky Syndicate, and Walker mines in Oklahoma. Ore from the three properties last mentioned is treated at the Eagle-Picher Central Mill.

Although not officially confirmed locally, it was reported on April 13 that the Eagle-Picher wage increase application had been approved by the NWSB, and, by that date, nearly all other companies operating in the district had filed, or were making preparations to file, for wage increase approvals.

## MISSOURI

### St. Joe Lead increases output of southeast Missouri mines in 1945—School of Mines offers fellowships

★Lead production from the southeast Missouri mines of the St. Joseph Lead Co. increased to 146,395 tons in 1945. The annual report of the company notes that production was slightly above 1944 output of 144,336 tons, and that this represents the only advance in lead output from any district in the United States in 1945.

Curtailment of development due to manpower shortage has reduced "proved" ore reserves of the southeast Missouri mines, the report states, but with the return of former employees from military service, considerable additional exploration work is now contemplated.

★The Missouri Geological Survey, at Rolla, will be housed in a remodeled three-story brick building formerly occupied by the USO. A State appropriation will enable the Survey to move from its old quarters in the Rolla Building, on the Missouri School of Mines campus, into the new location, which will provide 14,000 sq.ft. of floor space.

★Dr. R. S. Dean, assistant director of the U. S. Bureau of Mines, was the principal speaker at a joint meeting of the St. Louis and Rolla sections of the American Society for Metals held in Rolla on April 27. Dr. Dean discussed the preparation and properties of ductile titanium.

★The Missouri School of Mines and Metallurgy is offering research fellowships for graduate study and graduate assistantships to qualified applicants. Graduate work may be taken leading to Ph.D. or master of science degrees in mining, metallurgy, geology, or ceramics. Prof. J. D. Forrester is chairman of the committee on graduate study, which is receiving applications.

Enrollment at the School of Mines for the spring semester totaled 850 students, 100 percent above the fall enrollment and 400 percent higher than a year ago.

## ARKANSAS

### Exploration planned at Speer lead-zinc property—Opening of Jones Mill is delayed

★Manganese output from the Batesville-Cushman field during March totaled 1,083 tons, an increase of 626 tons over February production. Nearly all ore is now going to the furnaces. The folowing mines produced: R. P. Potashnick Co., 350 tons; Polk-Southard Mining Co., 325 tons; Arkansas Manganese Co., 316 tons; Walter H. Denison Manganese Co., 92 tons. Operations at the Potashnick properties have been closed down pending action on the stockpiling bill (Senate Bill 752) now before the House.

★Two new shafts are being put down on the Walter H. Denison Manganese Co. property, in the Pfeiffer district. Production from these openings is expected to begin within a few weeks.

★The Speer mine, in the north Arkansas zinc and lead field, has been taken over by W. S. King and J. C. Shepherd. Drilling operations are planned. The property is on the St. Joe fault, in Newton County. Previous drilling in this area by the U. S. Bureau of Mines is said to have given promising ore indications.

★J. C. Black, superintendent of the Reynolds Metals Co.'s Jones Mill aluminum plant, said recently that it is difficult under present conditions to set a date for the opening of the plant. Shipment of much of the material needed for reconditioning the plant has been held up by strikes. About 250 persons have been employed in the reconditioning of the property, which has been shut down since last September when the Reconstruction Finance Corporation canceled the lease held by the Aluminum Company of America.

★Joe Kimzey, State Geologist of

Arkansas, is constructing a small washing and concentrating plant to handle magnetite from the Magnet Cove area.

★It is reported that the Baroid Sales Division of the National Lead Co. has declined to establish operations at the Point Cedar lead mine, near Amity, Ark. The company's general superintendent and geologist recently visited the property.

★It was erroneously reported in this column in the March issue that the U. S. Bureau of Mines had discontinued operation of its bauxite pilot plant near Bauxite, Ark. The plant is still experimenting on the low-grade bauxite and bauxitic clays. The plant will probably continue in operation at least through the present fiscal year, which ends June 30.

## ILLINOIS and KENTUCKY

### Coal strike curtails fluorspar operations at Rosiclare—Mahoning company leases Kentucky properties

★The coal strike resulted in a temporary shutdown on April 6 of the flotation mills of the Rosiclare Lead & Fluorspar Mining Co., the Mahoning Mining Co., and the Inland Steel Co. at Rosiclare, Ill. The shutdown was effected to conserve coal for mine pumping operations and for supplying electric current for the light and water systems of the towns of Rosiclare and Elizabethtown, according to A. H. Cronk, superintendent of the Rosiclare company, which furnishes power for the other two plants and the two towns.

★Fluorspar companies of the Kentucky-Illinois district have resumed shipment of fluxing gravel fluorspar following settlement of the strike in the steel industry. Curtailed shipments were made to steel centers during the strike.

★Representing one of the major construction projects in the Kentucky-Illinois fluorspar district in recent years, a new shops building for the Aluminum Ore Co.'s plant at Rosiclare is nearing completion. The new structure will house the machine shop, electrical shop, and carpenter shop. The new building, which is 220 ft. long and 60 ft. wide, is of modern steel and brick construction, and will be one of the largest industrial shops in the Kentucky and Illinois region.

Additional construction includes installation of a new sink-and-float plant with a maximum capacity of 25 tons per hour. Delayed by shortages in materials, construction is 95 percent completed at the present time. Installation is for the purpose of beneficiating low-grade reserves to add to total reserves on the property. It will be used in connection with the flotation mill to float ores to grade.

★Leases on three Kentucky mining

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## Illinois and Kentucky
*(continued)*

properties recently were acquired by the Mahoning Mining Co., according to J. G. Trewartha, vice president. These include the Mineral Ridge, Klondike, and Delhi Babb properties. Development is in progress. Electrical equipment has been installed at the Delhi Babb fluorspar mine, formerly steam operated.

★Installation of a small flotation mill at the Davenport mine, 8 miles south of Marion, Ky., has been completed. B. E. Clement is operator of the property. The operation effects flotation of fluorspar fines from a jig mill.

★The government-owned "Corod" plant at Marion, constructed during the war for differential flotation of zinc, lead, and fluorspar, is offered for sale by the Defense Plant Corporation. Construction was started in 1941 and completed in 1943 at a cost of $252,000. Only one month's operation was recorded. The property embraces approximately 31 acres of land, a mill building with a floor area of 11,000 sq. ft., flotation machinery, and a laboratory and office building.

★Installation of a new Ottumwa double-drum electric hoist at the Blue Diggings shaft is being made by the Aluminum Ore Co. An electric pump will be installed, and the present steam plant at the shaft shut down. The new equipment will permit more economical use of power from the central generating plant. Development work on the 800-ft. level has begun.

# MICHIGAN

### Calumet & Hecla strike averted—Company head assails premium payment formula

★Calumet & Hecla Consolidated Copper Co. and Copper Workers Local 584, of the International Mine, Mill and Smelter Union, CIO, have entered into a new contract, thereby averting a strike called for May 4. The strike vote was taken on April 4. The contract calls for an 18½c. an hour increase, retroactive to April 1, 1946. The union withdrew its demand for an afternoon and night shift wage differential, and also for a union shop. The contract calls for the continuance of the maintenance of membership clause and the automatic check-off.

★Isle Royale Copper Co. has offered its employees a wage increase of 18½c. an hour, retroactive to April 1.

The wage increase by both Calumet & Hecla and Isle Royale will be met by the Federal Government, which has agreed to a higher subsidy under the premium price plan to meet the additional cost.

★Copper Range has appealed the March 21 decision of the Appeal Board of the Michigan Unemployment Compensation Commission, which ordered the company to pay unemployment benefits. The appeal will be heard in the Circuit Court of Ingham County, Mason, Mich. The action again ties up the payment of benefits to 539 Copper Range employees and to approximately 50 others who found employment in the logging industry after the mine closed, but who have been unemployed during the spring break-up.

The Copper Range workers, through their local union, have won three decisions dated Oct. 1 and Dec. 3, 1945, and March 21, 1946, to the effect that they are entitled to such unemployment benefits.

★E. R. Lovell, president of the Calumet & Hecla Consolidated Copper Co., recently made the following statement concerning the copper price situation:

"OPA has refused to raise the basic price of copper above its present ridiculous and artificial level of 12c. per pound. Instead, increased premium payments in the form of subsidies will be paid to producers to compensate for higher costs brought about by wage boosts. Thus the taxpayer, and not the consumer, is stuck for this latest masterpiece of legerdemain.

"This is a shot in the arm, and as far as the Michigan district is concerned may look all very well for the time being. In the long run, however, when government support is withdrawn, the grim return to common sense economics will be painful and difficult.

"Only through increased productivity on the part of labor can the new wage levels be supported. The idea of a good day's work for a good day's pay must become a habit; otherwise we are headed for disaster. Management, too, must do its part by developing labor-saving devices and reducing costs through improved production methods. If labor and management work together in complete harmony, much can be accomplished."

★Calumet & Hecla has established a miners' school on the 49th level of Ahmeek No. 3 shaft. Eight men are taking their first training in underground work, and nine are former trammers or laborers. Each student miner is placed in a stope with an experienced miner and is taught methods of operating a machine under actual conditions.

Ex-servicemen accounted for a large number of men hired for underground work in the Calumet & Hecla during the past month. Some are former employees.

★Advanced students of mining engineering and allied subjects at the Michigan College of Mining and Technology will take intensive summer trips of six weeks' length, alternately to the Rocky Mountain area and to the Canadian mining regions. Inspection of the Mesabi and Vermilion ranges of Minnesota will be common to all itineraries. This year's trip will also include the Black Hills, Salt Lake area, Colorado, the Joplin district, Wyoming coal and oil fields, and southern Illinois coal fields.

This is in accord with the aims of Prof. J. Murray Riddell, head of the department of mining engineering, who has been working to expand the staff and increase the number and scope of field trips.

# IRON COUNTRY

### Strike continues to paralyze ranges — Minnesota wins subaqueous ore-bed suit

★The strike deadlock continues between iron ore miners and independent operators on the Marquette, Menominee, and Gogebic ranges. With the exception of one underground mine on the Gogebic range, operated by the Oliver Iron Mining Co., no ore is being hoisted. Workers of independent companies are talking of preventing even the Oliver men from going to work at an increase of 18½c. per hour, as they fear Oliver ore sold on the open market may find its way to the furnace stacks of some strike-bound companies.

During the week of March 24, about 600 workers on the Marquette Range, who were willing to return to work for the offered 10c. per hour increase, returned to their places, but mass demonstrations staged by the unions at several properties discouraged the workers from going back a second time. State conciliators are meeting with the mine operators, but the union stands firm on not meeting any terms less than 18½c. per hour. Union leaders declare that there can be no negotiating until temporary injunctions issued during the latter part of March by two circuit court judges are set aside. One reason for delay in negotiating is due to the hourly increase of 18½c. per hour granted workers in the copper country. This was made possible through a subsidy granted at Washington on copper. Similar efforts are being made to get a rise in iron-ore prices, but government officials are unwilling to concede that a ton of iron ore mined underground should cost more than that mined from an open pit. Both sides are hoping for an early settlement, but the picture is not bright.

★A recent decision in a State district court at Duluth, holding that the State is owner of iron ore under Syracuse Lake, means a possible income of $25,000,000 to the State from ore royalties. The court ruled that the State is owner of the beds below low-water mark, holding them in its sovereign governmental capacity for the benefit of the public. The decision was given in the case of the Longyear Holding Co., Minneapolis, and about $2,000,000 was involved. The State estimates that there are 4,000,000 tons under Syracuse Lake, on which it receives $.50 royalty per ton. The money has been deposited in escrow. Other

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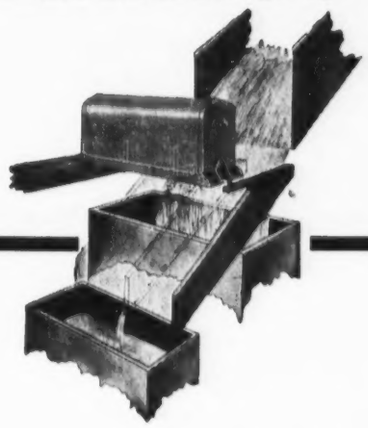

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## Iron Country *(continued)*

known deposits of iron ore under similar beds in Minnesota are estimated to total 25,000,000 tons. In addition, the Department of Lands and Minerals estimates there is about 25,000,000 tons that has not been explored. The ruling automatically decides the outcome of a case pending in Brainerd, Minn., where a large deposit of ore under Rabbit Lake, in Crow Wing County, on the Cuyuna Range, is involved.

★The first ship of the season arrived at the Duluth port on April 10 to open the 1946 interlake navigation season. Interlake navigation was opened last year on April 4.

★An iron powder plant costing $650,000 will be built six miles north of Aurora, on the eastern end of the Mesabi Range. A recent engineer's survey disclosed the cost would be approximately double the original estimate. The increased cost was recently approved by the members of the advisory committee of the Iron Range Resources and Rehabilitation Commission. The plant, of 5 tons' per day capacity, will be constructed by the Stearns-Roger Mfg. Co., of Denver, Colo.

★The tentative goal of 60,000,000 tons of iron ore set by Great Lakes shippers for the 1946 season would represent the smallest movement of ore since 1939, and reflects the impact of the steel strike on stockpiles. Ore consumption for 1946 was reduced at least 8,000,000 tons by the strike, according to a recent estimate. Lake shipments totaled 75,714,750 tons in 1945.

# NORTH CAROLINA

### Mica producers fight anti-trust suit —Large sillimanite deposit is studied

★Decision was deferred at a hearing on April 6 by U. S. District Judge E. Yates Webb at Charlotte, N. C., on a petition by the Wet Ground Mica Association, the Asheville Mica Co., et al, for a bill of particulars in the Government's case against them in which violation of the Sherman Anti-Trust Act is charged. Judge Webb gave Government and defense attorneys 20 days in which to prepare rebuttal briefs.

The association and companies were indicted by a U. S. Grand Jury at Asheville, N. C., in August 1945. Conspiracy to fix prices and determine the markets through which sales should be made was alleged.

In asking for the bill of particulars, attorneys for the defendants contended that the companies should know the specific charges which the Government intends to press against them. Attorneys for the Government claimed that the main issue in the case was the alleged conspiracy and that specific acts under the charge should be considered as evidence not to be brought out until the trial.

★Discovery and investigation of extensive deposits of sillimanite, an aluminum silicate, is reported in an information circular prepared by Charles E. Hunter and William A. White and released by Jasper L. Stuckey, State Geologist, for the Department of Conservation and Development.

The mineral occurs in a zone 10 miles wide and about 95 miles long, which starts at the South Carolina line in Rutherford County and extends northeasterly to the Yadkin River near Elkin. The report notes that other large deposits may occur near this zone or at other places in the state. Dr. Stuckey stated that, so far as he knew, no deposits of similar extent had been found outside Georgia.

The report indicates that the mineral might be found highly suitable for use in manufacturing refractories and for other uses where high resistance to heat, chemical attack, and low coefficient of expansion are required. Tests of the North Carolina ore are now being conducted at the TVA laboratory at Muscle Shoals.

It is estimated that perhaps 15,000 to 20,000 tons of the mineral might be utilized annually at a probable cost of $20 to $35 per ton. The ore studied in the survey runs around 25 percent concentrated mineral.

# ALASKA

### Coastal areas returned to public domain — More small placer operations resume

★Large coastal areas, withdrawn in 1943 "for use in connection with prosecution of the war," may be returned to the public domain. If Secretary Krug approves an order which has been drawn up by Oscar L. Chapman, assistant Secretary of the Interior, 18,640,000 acres will be restored. A reserve of 15,600,000 acres is on the Alaska Peninsula, and 3,040,000 acres is reserved in the Katalla-Yakataga region. The 48,800,000 acre reserve in northern Alaska is being explored for petroleum by the Government, and restoration of this land is not contemplated at present.

★The Little Minook Mining Co., with placer property near Rampart, will add a dragline, dozer, and pumping unit to its equipment and operate with an eight-man crew this year. Albert Bernard and partners, of Fairbanks, are the owners.

★The Cleary Hill mine plans to resume placer operations on Eureka Creek, in the Manley Hot Springs district, according to Ralph Wyer, manager. A dragline and other equipment which was purchased by the Army will be replaced.

★Wallace Porter, of Haycock, has stated that sluicing operations will be resumed on Candle Creek. The dredge on his property on Dime Creek, which has been idle since the war, will be repaired and placed in operation next year.

★The Wolf Creek Mining Co., with placer ground near Fairbanks, expects to work one shift with a crew of eight or nine men. Mannie Olson, manager, states that sufficient surplus Army equipment for the property's use was purchased last year.

★The Interior Mining & Exploration Co. has been organized by William F. Crown and associates. A lease on Valdez Creek placer ground has been acquired from Carson and Conn, who operated the property before the war. It is planned to use a crew on hydraulicking and drilling this year and later to install a dredge.

★The Ramstad brothers are resuming placer operations on Kako Creek, a tributary of the Yukon near Russian Mission, after a prewar shutdown. They have purchased and reconditioned a dragline which was acquired from Army surplus property.

★Harold Christensen, manager of the C. J. Berry Dredging Co., at Miller House, has returned from the States to resume active operation of that property and, in addition, will be in charge of the Deadwood Mining Co.'s placer operation near Circle. The properties have not been operated since the war. About 30 men will be employed on the two projects.

★The mill of the Fern mine, which is in the Willow Creek district near Anchorage, was recently completely destroyed by fire. The estimated $75,000 damage was partly covered by insurance. Torches being used to thaw pipes were considered the cause of the fire. This year's scheduled operations will be cancelled, according to Al Dodson, manager. The mill will be rebuilt when conditions permit.

★Arctic Circle Exploration Co. will employ about 200 men this season, according to Gene Jack, superintendent. Prospecting for asbestos and jade will proceed in the Kobuk area, and gold dredging will be carried on at Candle. James Robbins is manager of the company.

★Charles Johnston, president of Alaska Miners' Association, at a meeting in March warned members holding unpatented mining claims in Alaska that if they wished to retain the claims without doing annual assessment work for another year, they must file declarations of intention to do so and pay the usual fee by July, 1947.

★E. F. Wann will serve as manager of dredges on Coal Creek and Woodchopper Creek this season for McRae-Patty Mining Co.

★Mining Exchange, a new venture, has been started in Fairbanks by Mrs. Lois McGarvey, designed to serve persons wishing to list properties for sale or lease. Information will be furnished

on values shown to date, maps, travel details, and mineral possibilities of the various mining districts.

★Bob Watkins, together with Ernie and Charles Peterson, will operate a placer property on Faith Creek, in the Circle district, this season.

★J. M. Elmer and two sons, together with Walter W. Johnson, will reopen the Slate Creek property, near Nabesna. They have taken in a tractor, trailers, and 100 tons of equipment and supplies. They are among the gold operators who are resuming work. Joe Nasenius will begin dragline and dry-land dredge work on Caribou Creek in the McKinley area. Vance Hitt will do stripping work on Poorman Creek, 60 miles from Ruby, with draglines and tractors. Charles Awe will use similar equipment on Marvel Creek.

★Erickson Engineering Co., financed by a group of Tacoma, Wash., stockholders, will resume operations at the Lucky Nell gold mine, near Ketchikan, this season, by driving a 600-ft. drift on a lower level than has been worked before, according to Aner Erickson, president. Milling at the rate of 50 tons a day will be started at the 8,000-ton mine dump.

★Livengood Placers, Inc., plans to complete its dam on the south fork of Hess Creek, about 9 miles from Livengood, this year. About 15,000 cu. yd. will be excavated and about 85,000 cu. yd. of material will be placed and rolled. The company is operating under a Reconstruction Finance Corporation loan.

★Little Minook Mining Co. will employ eight men, using a dragline, bulldozer, and pumps, at its placer property near Ramport. Among those in the enterprise are Didrik Thorson, Albert Bernard, Albin Martin, and Otto Arndt, all of Fairbanks.

★U. S. Smelting, Refining & Mining Co. is preparing dredge No. 3, at Chatanika; No. 8, on Goldstream; and No. 6, on Ester Creek, for work this season, according to R. H. Ogburn, superintendent. He reports labor scarce.

★Alaska Juneau Gold Mining Co. reported gross revenue of $119,047 for 1945, compared to $353,518 in 1944 and $1,455,861 in 1943, in its annual report ended Dec. 31 last. According to C. A. Norris, president, it is too soon to predict when economic production of gold can be undertaken.

## CANADA

### Mineral production for 1945 summarized—Steep Rock reports new financing plans

★Canada's mineral production in 1945 was valued at $479,587,911, according to a preliminary report prepared in March by W. H. Losee, chief of the Mining, Metallurgical and Chemical Branch, Dominion Bureau of Statistics,


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## Canada *(continued)*

and presented at the annual meeting of the Canadian Institute of Mining and Metallurgy in Montreal. This compares with the maximum obtained in 1942 of $566,768,672. Lower production was recorded for gold, copper, nickel, and zinc against increases for lead and iron ore. Gains resulted in the output of asbestos, barites, feldspar, graphite, gypsum, magnesitic dolomite, nepheline-syenite, clay products, cement, and sand and gravel; lower output was recorded for salt, quartz, sodium sulphate, sulphur, lime, and stone.

★Heightened activity in the mining industry was recorded on Feb. 1, 1946, with a total of 71,078 employees, of whom 2.4 percent were women. Weekly earnings reported by Ottawa averaged $39.39 on Feb. 1 for the mining industry, compared with the average of $32.03 for Canada's nine leading industries. Per capita weekly earnings for mining were at the same rate as on Feb. 1, 1945.

### ONTARIO

★Steep Rock Iron Mines, Ltd., has reported plans for financing production from the "A" orebody through the increase in capital stock to 8,000,000 shares. The sale of 500,000 shares was underwritten by Otis & Co., Inc., of Cleveland. The "A" orebody has been explored to a 400-ft. depth and has an indicated length of 3,200 ft. The width is given as 125 to 250 ft. Production from the "B" orebody in 1945 amounted to about 500,000 tons of ore shipped, which is expected to be doubled in 1946 and to increase ultimately to 3,000,000 tons a year. Consulting engineers are W. Samuel, Toronto; T. S. Armstrong, New Liskeard; Hugh M. Roberts, and William H. Crago, Duluth, Minn.

★Crowshore Patricia Gold Mines, situated near the east boundary of Albany River Gold Mines, Patricia district, has announced plans for shaft sinking to a depth of 1,000 ft. H. I. Kurtz, president, stated that the Ontario Hydro-Electric Power Commission was cutting a right-of-way for the transmission line to connect with the Pickle Crow mine. Early in April poles had been delivered and the power house and other buildings on the property were ready for plant installation. Extensive surface work and diamond drilling have been directed by Reginald Hore, consulting engineer.

★E. M. Thomson, president of Jason Mines, Ltd., reports the shaft dewatered and mining operations started in January. The mine is on Casummit Lake, 70 miles northeast of Red Lake. When shut down in 1942, the mine had probable ore estimated at 45,800 tons averaging $16.13 a ton. The second level is being extended north and south and the shaft is being deepened to open two new levels below the present 500-ft. depth of the No. 1 inclined shaft. The No. 2 vertical shaft is 1,500 ft. west of the No. 1 opening and reaches a depth of 300 ft., from which a vertical winze goes down another 500 ft. C. Rutherford is mine manager.

★Plans are to be considered for placing Starrat Olsen Gold Mines in production after shaft sinking is completed. The shaft is being deepened from 330 to 800 ft., to be followed by opening four new levels at 125-ft. intervals. In previous work on the 300-ft. level an ore length of 232 ft. was disclosed averaging $7.04 per ton over a 13-ft. width. Diamond drilling has indicated $10.83 per ton across 9 ft. at a depth of 450 ft. The property was acquired a year ago from Hasaga Gold Mines, Ltd. J. E. Hammell is president and A. E. Pugsley is mine manager.

★Kerr-Addison Gold Mines, Ltd., developing one of the major orebodies in Canada, reports ore reserves of 8,379,951 tons having an average gold content of 0.1975 oz. per ton after dilution above the 1,450-ft. level, and 2,002,000 tons grading 0.2043 oz. between this horizon and the 1,600 level, only partly developed. Broken ore amounts to 605,643 tons. W. S. Row, manager, stated in the annual report that tonnage of ore broken in 1945 increased 12 percent over that for the previous year, as a result of improved labor conditions. The mill rate was up to 1,280 tons a day at the end of last year. New work in 1945 on the 1,900 level disclosed a grade of 0.3526 oz. per ton over widths averaging 47 ft. in the No. 16 and No. 21 orebodies for a combined length of 615 ft. Four known orebodies on the 2,500 level have a combined length of 2,087 ft. across a width averaging 59.5 ft. and an average grade of 0.244 oz. By the end of 1947 plant capacity is to be increased to 4,000 tons a day. James Y. Murdoch is president.

### QUEBEC

★Louvicourt Goldfield Corporation reports that shaft sinking had reached a depth early in April of 190 ft., with an objective of 750 ft. The first level is to be driven at a depth of 200 ft. Based on extensive diamond drilling, ore is estimated at better than 2,500 tons per vertical foot, averaging about $6 per ton. Bulk samples treated by North American Cyanamid and the Ore Dressing Laboratories at Ottawa have shown the grade to be in excess of $9 per ton. Capacity of the mill purchased from Lapa Cadillac is to be increased to 1,000 tons a day. Construction of the surface plant has been completed. George H. Dumont is mine manager and Pierre Beauchemin is president.

★Francoeur Gold Mines, Ltd., in Beauchastel Township, reported ore reserves on Jan. 1, 1946, amounting to 230,400 tons averaging 0.187 oz. gold per ton. C. D. H. MacAlpine, president, stated in the annual report that substantial new ore was expected to be opened by the depth exploration now being planned. All ore is being shipped as flux for treatment at the Noranda

smelter, but the Francoeur mill is being improved for the treatment of low silica ore not acceptable by the smelter. The Francoeur ore structure has been explored over a 5,000-ft. length but is indicated by drill holes to have a total length of about 9,500 ft. Mine workings are to a depth of 400 ft. and all production has been secured on or above the 311-ft. level. The downward continuation of the ore, with some increase in gold content, has been indicated by drill holes. John W. MacKenzie is mine manager.

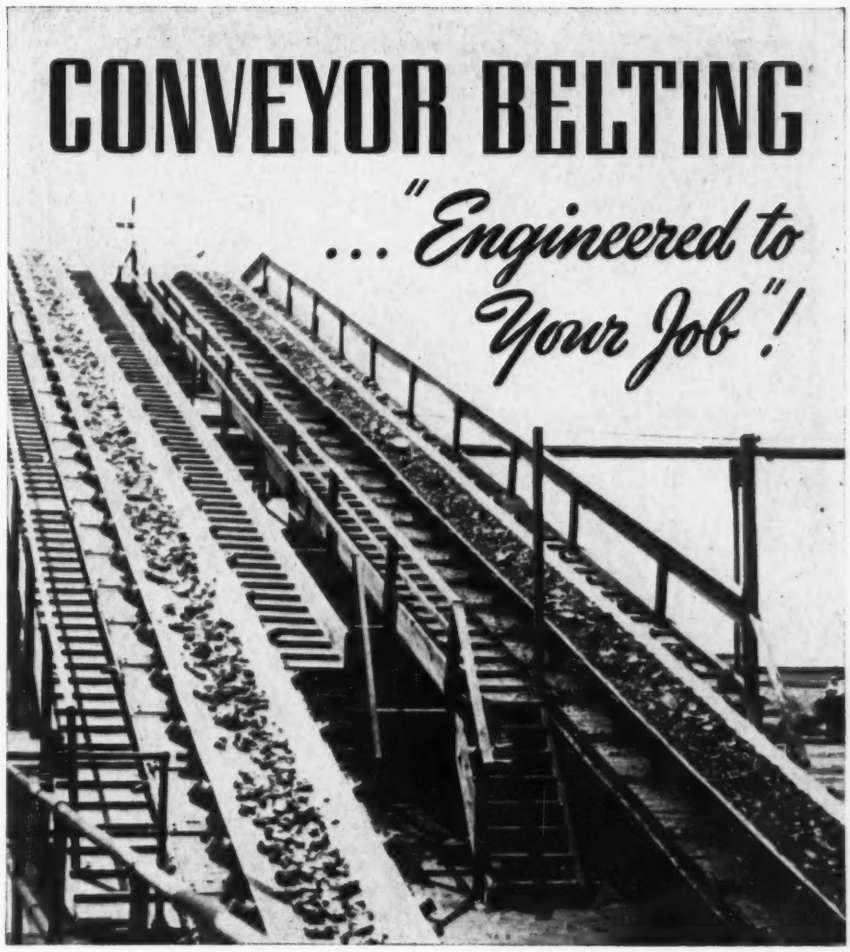
★Wasa Lake Gold Mines, east of the Francoeur mine, in Beauchastel Township, is making satisfactory progress in shaft sinking under the management of Walter H. Woods. Levels are to be opened at 200, 400, and 600 ft. A stage level with crusher station will be at the 800-ft. horizon, a loading pocket at 900, and a bottom stage level at 1,000 ft. Mill capacity is to be 1,500 tons, starting at 1,000 tons daily. Ore reserves based on diamond drilling are reported by Dr. J. E. Gill, consulting geologist, at 5,000 tons per vertical foot down to 750 ft. Two main groups of gold-bearing lenses, each 1,600 ft. long, are separated by a gap of 1,000 ft. The west section has been tested to a slope depth of 1,300 ft. and has five times the tonnage indicated to a depth of 700 ft. in the east section.

★Aubelle Mines, Ltd., in the Mud Lake area adjoining the Belleterre mine on the east, reports satisfactory progress in drifting on the 250-ft. level Face sampling along the drift 48.6 ft. from the crosscut indicated $15.91 per ton over a 6.4-ft. width, compared with $12.06 across 7 ft. secured from earlier diamond-drill intersections. The same No. 1 vein has been entered on the 500-ft. level and drifting was being started in April. Six or more smaller quartz veins were intersected by crosscuts on both levels. The new three-compartment shaft is down to 525 ft. R. W. Brigstocke is vice president.

★Thurbois Mines, Ltd., in Destor Township two miles east of Golconda Mines, has carried on extensive diamond drilling and is considering plans for shaft sinking. A. C. Lee, consulting engineer, reported an intersection on the "F" zone of 0.27 oz. over a width of 1.5 ft. in Drill Hole No. 67, at a depth of 440 ft. A length of 650 ft. has been indicated for the "C" zone. The president, J. D. Smith, reports cash on hand amounting to $300,000.

### MANITOBA

★Operations of Hudson Bay Mining & Smelting Co., Ltd., at Flin Flon, resulted in a net profit of $5,897,844 during 1945, equivalent to $2.14 per share. Gross income for the year was $23,390,997. A total of 1,822,628 tons of ore was mined and milled, from which were produced 80,195,057 lb. of copper, 94,936,880 lb. of zinc, 131,239 oz. of gold, and 1,694,184 oz. of silver. Development work continued to lag, due to labor shortages. The principal development work was accomplished in the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## Canada *(continued)*

vicinity of the south main shaft and consisted of crosscutting and drifting on the 2,750-, 3,000-, 3,250-, and 3,500-ft. levels. The ore pass from the 3,500 level was sunk to the 3,750-ft. level. The 1422 winze at the north end of the mine was extended to the 3,000-ft. level, and some drifting done on the 2,750-ft. level. A total of 44,726 ft. of exploratory diamond drilling was done. Stope development work amounted to 13,743 ft., approximately one-third of which was below the 2,210 level. The major item of construction was the erection of a metallurgical test plant, which will be completed during the coming year. In addition, the company undertook to build fifty new houses under the plan of the National Housing Administration to relieve an acute housing shortage. Improvements in the plant include an additional cyanide filter and ventilation equipment for the copper roaster calcine hoppers. The average number of employees in 1945 was 1,971, compared with 2,074 in 1944. The number of women on the payroll had been reduced to 123 by the end of the year. W. A. Green is general manager of Flin Flon.

★Hudson Bay Exploration & Development Co., Ltd., maintained four parties in the field in 1945, two in the southern Yukon and two in northeastern Saskatchewan. A camp was established on a discovery made the previous season in the southern Yukon, and diamond drilling was started. This program will be continued in 1946. One new discovery was made about a mile from the original find. Exploration diamond drilling was done on six properties held under option, and these options were dropped. Cuprus Mines, Ltd., in which Hudson Bay Exploration & Development Co., Ltd., holds a majority interest, has erected a sinking plant, consisting of a hoisthouse, a compressor plant, boiler room, and headframe. The plant site has been cleared and a bunkhouse, cookhouse, and changehouse have been constructed. The power line to the mine site has been completed and a truck road cleared and partly graded. Shaft sinking has reached the 125-ft. level, the first station has been cut, and ore pockets are nearing completion.

★San Antonio Gold Mines, Ltd., reports a net profit of $425,756 for 1945, equivalent to 17.8c. per share. Ore milled totaled 136,977 tons, producing bullion to the value of $1,477,995, an average of $10.79 per ton. Shortage of labor made it compulsory to draw ore from wherever it was most accessible, but by the end of the year an appreciable increase in the labor supply made possible an increase in production to 400 tons per day. A total of 2,047 ft. of lateral work was completed during the year, most of which was to establish points for diamond drilling and to provide entries to known ore. Underground diamond drilling was more than maintained, a total of 14,744 ft. being completed.

Work on the hoistroom and cableway on the No. 4 winze is under way. This new opening will develop the levels below the 16th. Because of curtailed development work, ore reserves at the end of the year had dropped to 740,000 tons, of which 107,000 tons were broken. C. F. Caswell is mine manager.

★The annual report of God's Lake Gold Mines, Ltd., for the year ended Dec. 31, 1945, lists total assets of $1,356,213, of which $400,000 is invested in bonds and the balance in other established mining companies. The mill and plant at God's Lake and the power plant at Kanuchuan have been maintained practically intact. Interests acquired include Wekusko Consolidated, Ltd., in Manitoba; Regcourt, Bevcourt, South Dufault, and Grand Terre, in Quebec; and Dominion Magnesium, Ltd., in Ontario.

### SASKATCHEWAN

★Present royalty rate will not be allowed to act as a handicap to new mineral developments in the province, J. L. Phelps, Natural Resources Minister, told representatives of mining companies at a recent conference in Regina.

"This royalty is a flexible rate," said Mr. Phelps in an announcement, "and any time it is shown to operate to the detriment of a company, individual adjustments could be made."

The minister revealed that a resident geologist for northern Saskatchewan would be appointed to assist prospectors. The meeting requested the department to press the Geological Survey of Canada to carry out scientific mapping at an accelerated rate.

Mr. Phelps said that 150 claims had been recorded in the Jo-Jay gold property, 60 miles northeast of Lac La Ronge. In the Flin Flon area, considerable diamond drilling and general prospecting are taking place at Amisk Lake and Kipahigan Lake, and claims have been staked at Reindeer Lake and Wollaston Lake. At Douglas Lake a 100-ton mill is being constructed for the recovery of arsenic and precious metals. Staking continues at Goldfields, where there are strong indications of a copper-nickel deposit. At Norita Bay a greenstone area is being prospected.

A road to Lac La Ronge, which will serve the Jo-Jay Lake, Sulphide Lake, and McKay Lake mining developments, is expected to be completed by midsummer, and a road from White Fox to Flin Flon to serve the Amisk Lake area is also being planned.

Dr. J. B. Mawdsley, geology department, University of Saskatchewan, urged that training courses be held for prospectors, and outlined progress of aerial photographing of the Pre-Cambrian Shield. J. Young, registrar of Security Frauds Prevention Act, reviewed security regulations regarding formation of mining companies.

Representatives of Hudson Bay Mining & Smelting Co., Consolidated Mining & Smelting Co., Churchill Mineral Exploration Co., and the Prospectors & Developers' Association were in attendance.

### BRITISH COLUMBIA

★The Allied Forces Exemption Act, adopted by the British Columbia Legislature, provides complete protection for all servicemen holding mineral claims in this province. All those protected under the 1939 Act, now automatically repealed, will continue to benefit provided they file claims before Dec. 31, 1946.

★Gross income of Premier Gold Mining Co., Ltd., for the year 1945 was $72,990, practically all of which came from the Silbak Premier and Toburn subsidiary operations. A substantial net profit was earned by Neptune Gold Mining Co., in Nicaragua, but a net loss resulted from operations of Saudi Arabian Mining Syndicate, Ltd. Plans are well advanced for the reopening of the Big Bell mine, in Australia.

★Production of Silbak Premier Mines, Ltd., Portland Canal district, during 1945 was 14,464 oz. gold, 85,304 oz. silver, and 2,697,977 lb. lead, valued at $567,314, from 65,801 tons, assaying 0.235 oz. gold, 1.66 oz. silver, and 2.31 percent lead per ton. Net loss for the year was $39,947. Two dividends, involving payment of $50,000, were charged against depletion. Development consisted of 1,587 ft. of drifting, crosscutting, and raising and was carried on in the Main ore zone and hanging wall thereof in Sebakwe, and in or near the principal orebody in the West ore zone in the B. C. Silver and Northern Light. Net smelter returns of $52,865 were received from February 1946 production. Recovery was made after treatment of 5,794 tons, averaging 0.24 oz. gold and 1.99 oz. silver per ton. Operating profit was estimated at $1,404 before write-offs.

★A contract has been let by Surf Inlet Consolidated Gold Mines, Ltd., for 10,000 ft. of diamond drilling on its properties on Princess Royal Island. Extensive drilling will be done to explore the 1,500 ft. intervening between the Surf and Pugsley mines. William H. Hax, president, states the company has on hand or available $330,000, a sum considered sufficient for the current development program.

★Milling will be initiated by September in the new plant of Cangold Mining & Exploration Co., Ltd., Alberni mining division, according to a statement by R. B. Gayer, managing director. In addition to approximately $85,000 cash on hand, the company holds a firm commitment for payment of $53,000 by May 15th.

★During the year ended Dec. 31, 1945, Bralorne Mines, Ltd., Lillooet mining division, produced 57,471 oz. gold, valued at $2,172,669, from 105,283 tons, averaging 0.565 oz. gold per ton. Other income amounted to $5,808. Dividend payments involved distribution of $1,122,300. After transfer of $321,150 from depletion account, earned surplus was reduced to $195,455.

Development work consisted of 5,222 ft. of drifting and crosscutting, of

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## Canada *(continued)*

which 1,271 ft. was in ore of minable width and grade. A notable feature of the vertical development was proving the strong upward extension of the "51" vein, in the most easterly section of the mine, where ore of good grade was found to the overburden. Ore reserves were estimated as of Dec. 31, 1945, at 1,088,000 tons, assaying 0.503 oz. gold per ton. In addition to this, Ira B. Joralemon, consulting engineer, estimates a further reserve of 200,000 tons averaging 0.20 oz. gold per ton, the value of which is dependent on future economic conditions. Because of the labor shortage no work was done during the year at the Nevada properties of Summit King Mines, Ltd., wholly owned subsidiary.

★Drifting has started on two parallel veins at a depth of 125 ft. below previous development in the Bridge River mine of Congress Gold Mines, Ltd. The two veins, separated by a horse of waste, aggregate 5½ ft. in width and assay 0.34 oz. gold per ton. Antimonial content has increased at depth.

★The steady improvement in the labor shortage situation is reflected in March production of Cariboo Gold Quartz Mining Co., Ltd., of 2,480 oz. gold, valued at $95,480, from 7,947 tons, averaging 0.31 oz. gold per ton. This compares with values of $78,540 in February and $52,591 in January.

★During the fiscal year ended Dec. 31, 1945, Island Mountain Mines Co., Ltd., produced 10,070 oz. gold and 1,376 oz. silver, valued at $388,253, from 22,614 tons, averaging 0.445 oz. gold per ton. Other income was $3,111. After operating costs of $277,102 and provision of $32,022 for taxes and $8,214 for depreciation, net profit was $74,001. Dividend payments required $73,550. Development work consisted of 382 ft. of drifting and crosscutting, 40 ft. of raising, and 2,121 ft. of diamond drilling. A body of rich replacement ore was discovered on the 3,375-ft. level, and its persistence was indicated on the 3,500-ft. level. Ore reserves were estimated at the year-end to contain 62,700 tons averaging 0.473 oz. gold per ton. Of this 44,000 tons averaging 0.346 oz. were in quartz veins and 18,800 tons averaging 0.769 oz. were in replacement bodies. March production was 1,507 oz. gold, valued at $58,036, from 3,384 tons, averaging 0.44 oz. gold per ton.

★With the necessary mechanical equipment now on hand, it is expected to extend the shaft of Canusa Cariboo Gold Mines, Ltd., to its projected depth of 320 ft. by the end of August. Work is being done on an area adjoining the B. C.-vein section of the Cariboo Gold Quartz mine.

★The Granby Consolidated Mining, Smelting & Power Co., Ltd., during the year 1945 produced 14,027,606 lb. copper, valued at $1,992,125 (Canadian). Cost of production after deduction of gold and silver recovered was $1,864,519. Administrative and other expenses aggregated $200,513. After provision of $14,665 for depletion and $110,468 for depreciation, net loss for the year was $196,242. This compares with a profit of $241,413 in 1944. One dividend of 15c. per share, involving distribution of $67,535, was paid. Ore reserves were estimated as of Dec. 31 at 10,559,000 tons averaging between 1.2 and 1.3 percent copper, which at capacity would provide mill feed for about seven years. Reserves of broken ore were increased to 527,179 tons at the end of the year. Julian B. Beaty, president, states: "The amount received per pound of copper for the 1945 production averaged 13.222c., which is 0.32c. less than we received in 1944. The increase in available manpower commencing about mid-November enabled the company to increase its development work considerably and to step up its present ore shipments to a basis of roughly 4,000 tons daily. Whether this production can be maintained depends upon the attitude of our employees and their union leaders. The union has recently filed certain demands, which are being carefully considered by the management, and meetings with the union leaders are now in progress; but it is obvious from the accompanying reports that these demands cannot be met at existing metal prices."

★A new compressor has been installed by Dentonia Mines, Ltd., Greenwood district, to speed up the development program. A drift on the 400-ft. level of the Jewel mine is in ore 8 ft. wide, averaging 0.66 oz. gold and 4.0 oz. silver per ton.

★Santiago Mines, Ltd., is negotiating with a Slocan district producer with a view to having the rich silver-zinc ore from the Bosun mine treated in the district, after which concentrate would be shipped to United States smelters. Silver-lead ore is shipped to the Trail smelter.

★Wellington Mines, Ltd., Slocan district, has let a contract for the construction of a road from the main highway to its Matheson-tunnel portal. A complete diesel-power unit has been purchased and a compressor ordered. The Matheson tunnel will be extended into an area 300 ft. lower in elevation than former workings in which ore of good grade was found.

★An offer to take over the entire assets of St. Eugene Mining Corporation, Ltd., has been received from Frobisher Exploration Co., Ltd., and will be discussed at an extraordinary meeting of shareholders of the former company to be held soon. St. Eugene has purchased the Lone Star copper-gold-silver mine, in the State of Washington, and a new company will be incorporated to direct development. St. Eugene will be entitled to repayment of $150,000 out of production from the Alaska Empire mine following its decision to withdraw from the project. The company holds an option to purchase 51 percent in the Golden Zone mine, in Alaska, where

several hundred thousand tons of ore of fair grade have been developed. There is a 300-ton mill on the property. St. Eugene is purchasing the Maid of Erin mine, in northwestern British Columbia, in which 35,000 tons of ore, averaging 18.0 oz. silver and 8 percent copper, have been proven by sinking, drifting, and diamond drilling. The company, having decided to confine its activities to lode mining, has leased its Quesnel district holdings to operators in the district and will share in any profits which may accrue. It will continue to hold the Ikeda copper mine, on the Queen Charlotte islands, where the production record shows 9,685 tons of ore yielded 8.15 percent copper, 2.33 oz. silver, and 0.139 oz. gold to the ton.

### NORTHWEST TERRITORIES

★Directors of Golden Slipper Mines, Ltd., have authorized an extensive diamond-drilling and surface-exploration program on the Merl group of 18 claims in the Desperation Lake area. All work will be under the direction of George E. Midgley, consulting engineer.

### YUKON TERRITORY

★Cyr Creek Gold Mining Co., Ltd., incorporated recently for $50,000, has 17 claims along Cyr Creek, about 185 miles northwest of Whitehorse, according to F. F. Pooley, president. The company planned to start exploration and development work in April.

★Frank Buckle will take over the interests of Treadwell Yukon Co., Ltd. He represents Keno Hill Mines, Ltd., and has gone to Mayo. The Keno company has purchased several silver-lead claims in the vicinity of the Treadwell property.

★George Black, Yukon member of the Canadian Parliament, has introduced a proposed amendment to the Yukon Quartz Mining Act which would bring it into conformity with British Columbia practice. In British Columbia a prospector may file one claim for himself and seven others if he does not file other claims within ten miles of the first in the same year. In Yukon, a prospector may stake one claim for himself and two for proxies.

## MEXICO

**New demands expected from non-silver miners — Fresnillo drops Parroquia copper mine**

★Mexico's labor situation continues uneasy despite settlement of the strike against the silver mines. Revision of work contracts for mines other than silver come up for readjustment in July, and apprehension is felt in many quarters over the possibility of another general strike in coal and metal mining. Non-silver miners are acutely conscious of the pay increases and other benefits won by silver miners,


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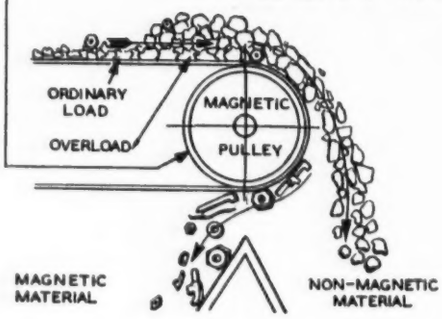


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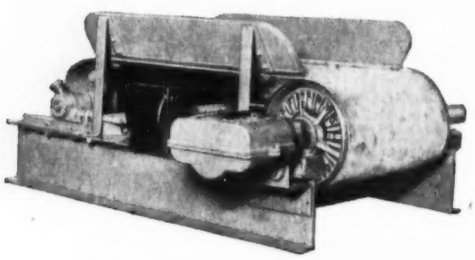

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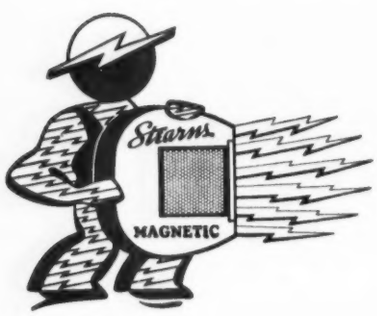


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## Mexico *(continued)*

and there is little likelihood that similar demands will not be forthcoming against non-silver mines. Some explanation of these demands will be given at the mine union's convention held in Mexico City early in May.

★Guanajucato Consolidated is reported to be arranging resumption of operations in the Guanajuato City sector. Plans are said to call for employment of 800 persons.

★Rising metal prices have aroused interest in various mining areas in Nuevo Leon, Coahuila, and Tamaulipas, according to the agency in Monterrey of the Ministry of National Economy. Old properties, abandoned because of low metal prices, are being reopened and new deposits are being sought.

★Potosi Mining was recently absolved by the Federal Supreme Court from obeying an order of the Board of Conciliation and Arbitration to pay severence to a worker discharged for using company tools for his own benefit. The Court ruled the discharge justified and exempt from indemnification.

★Fresnillo has asked the Labor Ministry for permission to suspend operations in its Parroquia mine, near Zacatecas, contending that mining there is no longer profitable. About 200 men would be affected, all of whom would be duly compensated for dismissal. The mine is a small copper property, operated as a war measure by the Fresnillo company.

★Workers of the Cia. Minera El Tajo, San Ignacio, Sinaloa, have asked both state and national authorities to turn the mining property over to them to be run as a cooperative. The mine was closed some time ago because of alleged unprofitable operation, but dismissal wages were not paid, because of lack of funds. The workers hope to satisfy their claims by means of cooperative operation.

★Following the recent example of the United States, Mexico adopted in March a new law providing that underwater mineral resources of the continental shelf are to be considered national property. This is, so far as Mexico is concerned, merely an extension of the constitutional proviso nationalizing mineral rights.

## CHILE

### New mine safety code calls for bureau inspections—Copper mine costs reported rising

★As a consequence of the catastrophe that caused the loss of more than 350 lives at the Braden Copper Co. six months ago, a new mining code, comprising 12 titles and 152 articles, has been drawn up and was recently signed

by the president of the Republic. This code deals with various safety measures to be observed in mining and provides authority for Bureau of Mines' inspection of mining properties.

★Because phosphorus seems to be demanded for proper fertilization of Chilean soils even more than nitrogen, increasing interest is being shown in development for domestic use of apatite deposits in northern Chile. Occurring as replacement veins associated with granodiorite intrusions, the deposits extend from Coquimbo to Vallenar. They are owned in large part by two companies: Cia Salitrera de Tarapaca y Antofagasta, and Cemento Melon, the last-named of which also owns the largest cement plant in Latin America (500,000 tons yearly. The former company plans a new phosphate plant near the port of Huasco, and the latter company expects to build a phosphate plant near Coquimbo. Cemento Melon has been producing phosphate fertilizer at Calera, under Messerschmitt patents, which produce a soluble phosphate by calcining a ground mixture of apatite, anhydrous sodium sulphate, and coal in rotary kilns.

★Development of the Delirio mine, at Punitaqui, has reached a point where the company contemplates building a 300-ton mill to recover cinnabar and a copper-gold product by differential flotation. The Delirio mine is on the south end of the Punitaqui vein, but the oreshoot is distinct from that worked in the Punitaqui mine.

★Under the influence of reports of increasing lead shortages in the United States, coupled with a rising world price for the metal, Chilean miners are again turning to the lead district that extends from Domeyko north to Copiapo. If sufficient lead ore can be found in the region, the Caja de Credito Minero will consider adding a lead flotation section to its cyanide mill at Domeyko.

★Development work has begun at Lago Buenos Aires lead-zinc property to prove the size of the orebody, and all necessary machinery has been installed. Capital for the venture has been subscribed by Punitaqui Gold Co. and the Corporacion de Fomento, the Chilean equivalent of the Reconstruction Finance Corporation.

★According to figures recently published by the Banco Central, the value of 1,029,470,768 lb. of copper produced in 1944 by the three American companies was $108,686,340, of which $83,132,060 went to pay production costs in Chile, to import supplies, and to pay Chilean taxes. The value of this production returned to Chile was distributed as follows:

| | Total | C./Lb. |
|---|---|---|
| Production cost ..... | $44,730,000 | 4.34 |
| Fuel and supplies..... | 15,588,695 | 1.51 |
| Chilean taxes ..... | 22,813,365 | 2.22 |
| | $83,132,060 | 8.07 |

The sale value of the copper not returned to Chile was distributed as follows:

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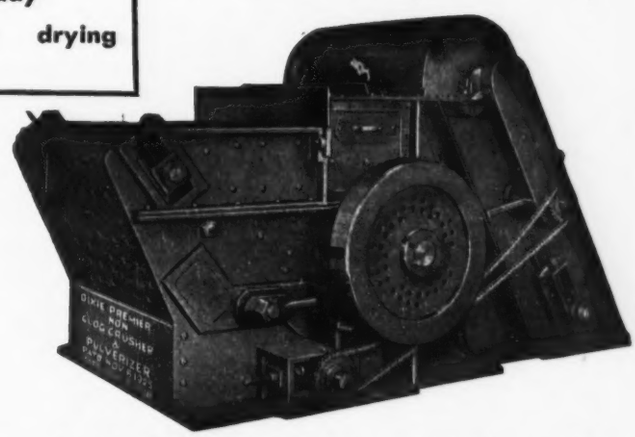

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## Chile (*continued*)

| | Total | C./Lb. |
|---|---|---|
| Dividends | $17,378,511 | 1.69 |
| Depletion, etc. | 7,896,549 | 0.77 |
| Expenses abroad | 279,220 | 0.02 |
| | $25,554,280 | 2.48 |

Rising costs are shown by the following figures, also released by the Banco Central:

| Year | Production, Lb. | Cost, C./Lb. | Chilean Taxes, C./Lb. |
|---|---|---|---|
| 1941 | 976,482,200 | 2.66 | 1.22 |
| 1942 | 1,023,724,940 | 3.41 | 1.70 |
| 1943 | 1,046,084,520 | 4.18 | 2.42 |
| 1944 | 1,029,470,768 | 4.34 | 2.22 |

★Several American experts in blast-furnace and open-hearth operation are now in Chile under contract with the Corporacion de Fomento to assist in development of the new iron and steel project at San Vicente near the town of Concepcion Th.e plant will be built with the proceeds of a loan made to Chile by the U. S. Export-Import Bank.

★Both Anaconda subsidiaries in Chile continue to work at full capacity, and Braden Copper has been producing at about 70 percent of capacity. Local mining circles were heartened recently by news of contracts concluded with the United States for 90,000 tons of copper and with Great Britain for 30,000 tons. Price in both contracts was set at 11⅞c., f.a.s. Chilean ports, a rise of ⅝c. over the old price.

★A Belgian economic mission arrived in Santiago recently to bid for supplies of copper and other products, in return for which the group hopes to sell Belgian goods in Chile.

★Construction of a 30-ton flotation and cyanidation mill is being considered at the Sara mine, in the Chanaral gold camp. More than 100,000 tons of milling ore are said to have been developed at the mine, most of the shares in which are owned by Andes Copper Co., engineers.

# AFRICA

### Tax relief for gold mines in new budget—Government to take hand in Miners' Union affairs

★By transferring a number of natives from surface to underground work, and by reason of some improvement in labor supply generally, both production and development in the Rand mines materially increased during 1945, according to a report by R. R. Vail, president of the association of mine managers. The safety record has been good, the fatality rate of 1.45 per 1,000 workers holding closely to that of 1.43 for 1944. Costs continue to rise, however, and the cost of producing an ounce of gold is now given as 118s, 10d, against 112s 11d in 1944. Employment, development, and production figures are given in an accompanying table.

★With the new budget, the first step has been taken toward a new policy on mine taxation, which will considerably assist mining but which is not regarded as a complete solution to the problem. Basic taxes, formula taxes, and "special contributions" paid by gold mines in 1944 totaled £16,355,000, and profits from leased mines brought the Government's take to about £18,000,000. The special contribution, 22½ percent of gross profit, is eliminated, as are the natives' pass fees and the claim license money. The basic tax of 3s per pound sterling also is cut out. New mines will have capital expenditure that ranks for redemption treated as a cost for tax purposes, and treatment of this item for existing mines will be modified through relief in amortization allowance. The formula tax, however, will be adjusted upward to recoup some of the foregoing losses. This formula figures taxes on a ratio of profits to recovery, and it would appear that a low-grade mine, where this ratio is 6 percent or less, would pay no tax. Low-grade mines and new mines are encouraged by the new measures.

★Central Mining & Investment Corporation announces that the Basal Reef has been cut at a depth of 5,826 ft. in the unsurveyed hole drilled in the Odendaalsrust district, Orange Free State. Free State Development & Investment Corporation, Ltd., reports that first deflection of bore hole PH1, northwest of Odendaalsrust, cut the Basal Reef at 5,398 ft. Assays of most of the cores recovered ran around 3 dwt. over 6 to 10 in.

Mining companies at Northern Rhodesia are not prepared to grant wage increases at present, according to a joint announcement of representatives of the Northern Rhodesia Mine Workers Union and the Mine Managers' Committee. The workers had asked for a 25 percent increase, but apparently agreement has been reached on simple contract modification without wage increase.

★Government inquiry into the affairs of the Mine Workers' Union has been incorporated in the terms of settlement of the labor dispute that has harassed Rand mines since the first flare-up in February. Spreading from the first work stoppage at Durban Roodepoort Deep, over dismissal of a worker for non-payment of union dues, the wave of strikes has involved all the Rand mines at one time or another. Time lost ranged from one day to ten days, and earnings of most mines have been seriously affected. Total profits for seven mines, for example, were £40,451 in January; total losses for the same mines in February were £33,122. Intra-union squabbles are blamed by many for the strikes, and Government intervention in union affairs is in prospect. A special trustee and an investigating commission have been appointed, and a completely new set of union officials must be chosen in a Government-supervised election.

★Closed to gold prospectors by Government order during the war, Tanganyika Territory has been reopened and activity has increased. Gold output reached a prewar high of £1,250,000, and fell to a low, for 1945, of £442,000. Output of diamonds for the Territory in 1945 was £726,000 from deposits worked only since 1940. Other 1945 exports included mica to the value of £82,000, and 187 tons of tin, valued at £41,000. Development is proceeding at the new lead property found recently in the area south of the Central Railway not far from Lake Tanganyika.

### Average Monthly Output Figures, Rand Gold Mines

| Year | Natives Employed | Tons Milled Monthly | Development Ft./Month |
|---|---|---|---|
| 1939 | 327,228 | 4,862,000 | 205,050 |
| 1943 | 293,136 | 4,996,100 | 120,250 |
| 1944 | 267,140 | 4,875,400 | 131,950 |
| 1945 | 295,617 | 4,908,000 | *143,260 |

*January to September.

# AUSTRALIA

### Gold outlook gloomy—Fiji mines improve position — New Zealand dredging companies report

★The outlook for gold mining in Australia is discouraging. Some months ago the Commonwealth Government set up a Mining Advisory Panel to prepare recommendations as to the needs of the industry for rehabilitation. It has yet to be seen whether the industry will derive any benefit from the work done. A recent Government announcement indicates that there is little desire to assist the industry, and especially gold mining, to recover from the effects of the war. The Government has stated that permission will not be given for the flotation of any gold mining company with a capitalization exceeding £A10,000, control of capital issues being still retained by Government. The public is ready to support legitimate mining, and ample capital is available for this purpose. The Commonwealth Government's action will therefore have a serious effect on an industry which can have an important influence on national wealth and employment. Western Australia will be the most affected of the states, for gold mining occupied the leading industrial position in prewar years, the annual production of gold approximating 1,250,000 oz.

★For the four weeks ended Feb. 6, 1946, zinc output at the Risdon works of Electrolytic Zinc Co. was 5,928 tons. The West Coast mines of the company treated 9,916 tons of ore and produced the following tonnages of concentrates: lead, 589 tons; zinc, 2,788 tons; copper, 222 tons. Output at the Risdon works

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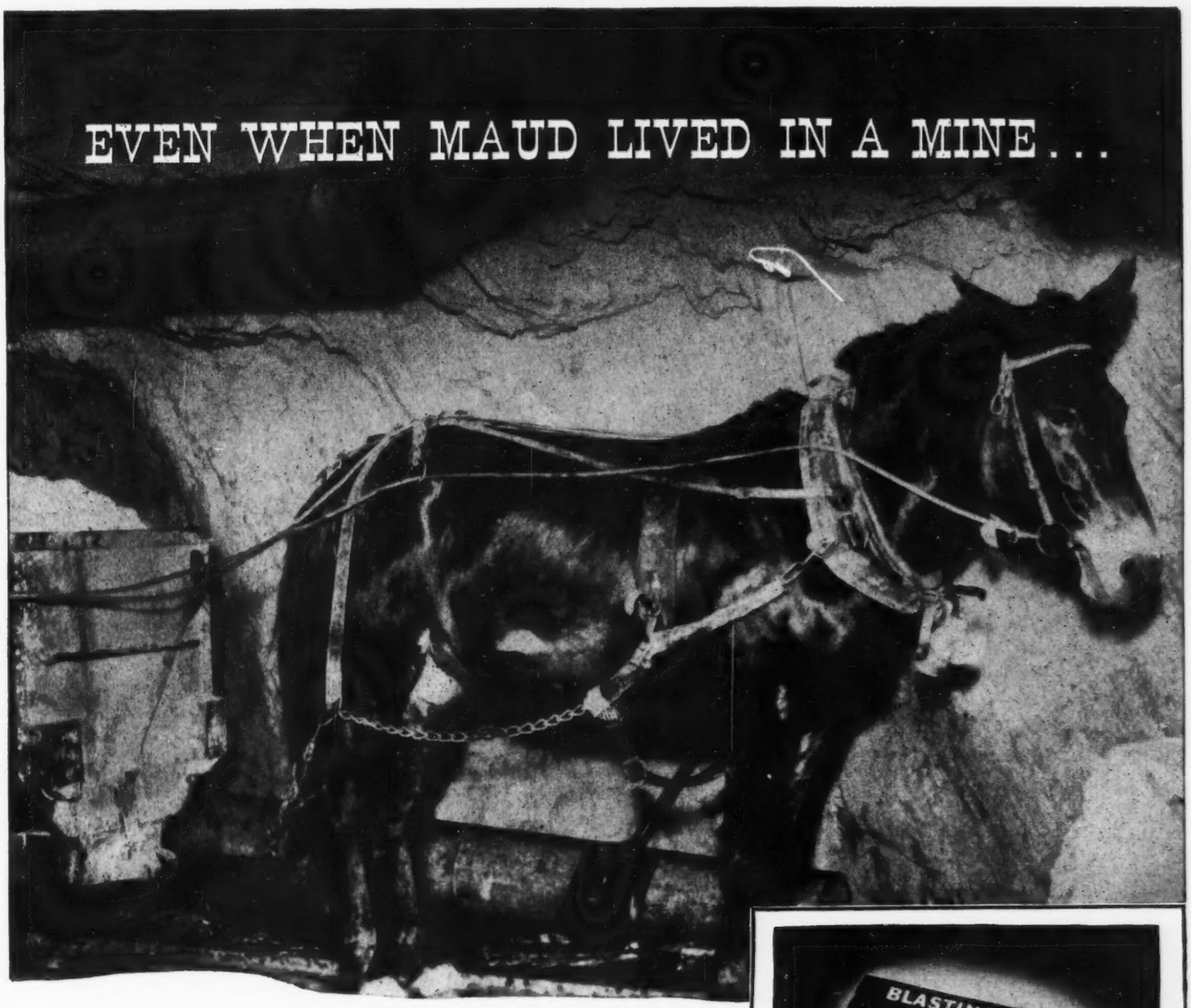

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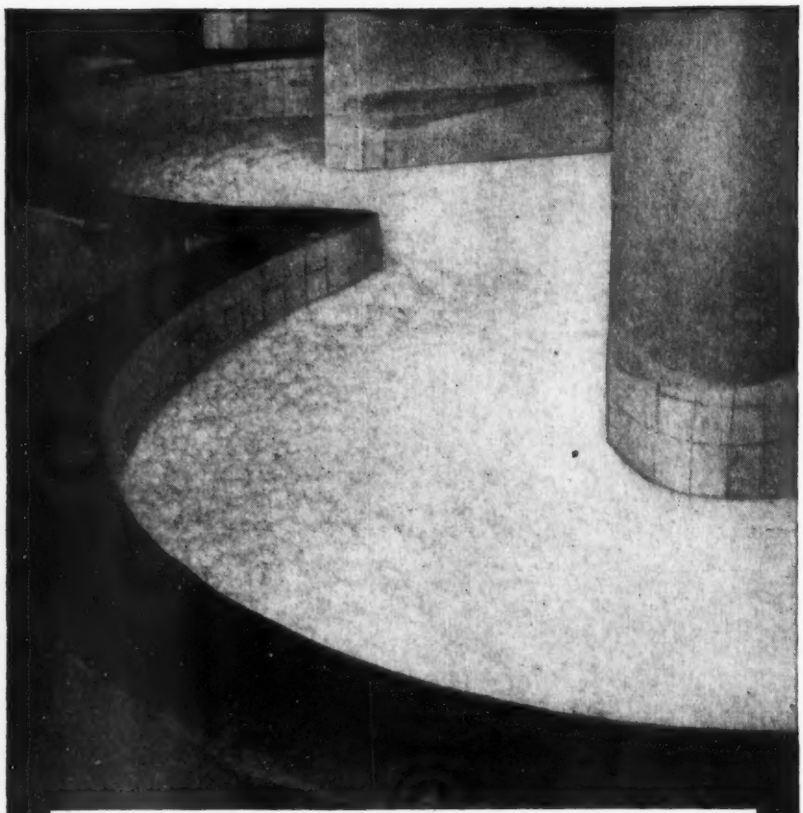

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## Australia *(continued)*

was curtailed during the period owing to interference of shipping difficulties with supply of zinc concentrates and calcine from the mainland.

★North Broken Hill, Ltd., for the four weeks ended March 2, 1946, produced: 6,123 tons of lead concentrate assaying 72.5 percent lead, 4.6 percent zinc, and 35.2 oz. silver; and 62,75 tons of zinc concentrate assaying 51.8 percent zinc, 1.1 percent lead, and 1.5 oz. silver.

### WESTERN AUSTRALIA

★Australia's greatest gold mine, Lake View & Star, Ltd., at Kalgoorlie, earned a net profit of £A276,549 in the year ended June 30, 1945, the previous year's profit being £A311,819. The reduction was due partly to increased development expenditure, following a slight improvement in the labor position, and partly to a smaller tonnage of ore treated and a decrease in grade. Large reserves have enabled the company to carry on successfully through the six difficult years of war, when, despite inadequate labor and restricted development, the ore-reserve position, assisted by reduced output, has been maintained close to the prewar level. Development increased by 1,284 ft. to 9,985 ft. and further increase will be possible as the labor supply improves. Driving amounted to 5,907 ft., of which 3,128 ft., or 53 percent, was in ore of an average grade of 5.7 dwt. gold per ton, with an average width of 59 in. It is considered, from the results obtained, that a large tonnage of ore remains to be developed and that new and important orebodies will be discovered when further exploratory work is carried out. The deepest workings in the mine are between 3,600 ft. and 4,000 ft. from surface. Work on the eastern group of lodes was less successful than in those on the western side of the leases, only 35 percent of the footage driven being in ore, the best results obtained being an average grade of 7.3 dwt. for a distance of 51 ft. at the 1,200 ft. level on the Tetley lode. On the 2,480 level, a crosscut disclosed 288 in. of ore showing abundant free gold and telluride. Ore reserves were estimated at 4,021,000 tons having an average assay value of 4.95 dwt. gold per ton; positive and broken ore represented 92 percent of the total reserves. The total ore treated amounted to 310,291 tons assaying 5.17 dwt. per ton, and the plant recovery was 90.73 percent. In addition, 699,271 tons of residues, assaying 0.92 dwt., were cyanided in the re-treatment plant for a yield of 13,900 oz. The total gold realized during the period was 75,327 oz. Working costs, including tailings retreatment, were 28s. 6d. per ton in Australian currency, compared with 27s. 0.9d. in the previous year.

### NEW ZEALAND

Arahura Gold Dredging, Ltd., is one of the leading dredging companies in

the Dominion, and holds a property of 371 acres, which was estimated at the starting of work to contain 48,500,000 cu. yd. of an average value of 3.1 gr. gold per cubic yard. The average depth of the ground is 81 ft. In the last year the dredge operated 6,356 hr. and treated 3,424,000 cu. yd. of ground, or 29 acres, for the recovery of 19,526 oz. of gold, 966 fine. The average recovery was 2.74 gr. per cubic yard. Net value in pence, 11.67 per cubic yard. Working costs were 3.59 pence per cubic yard. The dredge has a capacity of 400,000 cu. yd. per month and is equipped wtih 18 cu. ft. buckets.

★Another large dredging undertaking is that of Kanieri Gold Dredging, Ltd., which operates a dredge of 400,000 cu. yd. per month capacity, equipped with 18 ft. buckets, digging depth being 85 ft. with a bank of 30 ft. The property is of 533 acres, containing 55,000,000 cu. yd. valued at 9.3d. per cubic yard, with gold at £A6 per ounce. In the last operating year, the dredge worked 5,948 hr. and treated 2,351,000 cu. yd. of ground, or 37.83 acres, for the recovery of 13,418 oz. of gold, of 960 fineness. Recovery was 2.74 gr. per cubic yard. Net value was 11.57d. and working costs were 5.66d. per cubic yard.

## FIJI

During last year, the Fijian labor position improved, and stores were easier to obtain, but mine timber was in short supply and certain plant items were unobtainable. Emperor Gold Mines, Ltd., completed the joint mill for the treatment of its own ore and that from the neighboring Loloma mine. The company's net profit was £A91,981, which compares with £A22,877 in the previous year. Sinking of the main shaft was completed to 1,091 ft. from surface and No. 10 level plat was cut to a depth of 1,040 ft. An improved amount of development work, amounting to 4,232 ft., was completed. Production statistics were:

Ore milled, long tons, 113,074.
Head value, dwt. per ton, 6.99.
Residue value, dwt. per ton, 1.27.
Gold recovered, oz., 31,037.
Recovery, percent, 81.82.
Silver recovered, oz., 9,489.

Working costs per ton, in Fijian currency, were:

| | | |
|---|---|---|
| Mining | 8s. | 7.44d. |
| Milling | 15s. | 0.90d. |
| General expenses | 5s. | 2.68d. |
| Total | 28s. | 11.02d. |

Mining of open-cut ore is approaching an end, and underground stoping operations are being extended; the ore from the stopes is of slightly higher grade than had been estimated. Ore reserves were estimated at:

Positive ore, 850,000 tons; assay value, 7.8 dwt. per ton; probable ore, 120,000 tons; assay value, 7.8 dwt. per ton.

★Loloma (Fiji) Gold Mines, N. L., since the commencement of operations,


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## Australia (*continued*)

has treated a total of 198,094 tons of ore for the recovery of 243,160 oz. of gold, of a gross value of £2,235,000 in Fijian currency. The company has now closed down its own mill and ore is treated at the joint mill, erected on the Emperor mine, and the more economical treatment methods have reduced costs. Development at the bottom levels has been disappointing. Much driving was done on the No. 6 level of the Loloma lode without discovering payable ore. At shallow levels on the Regent lode, sections of high-grade ore were proved and churn drilling located ore of moderate value at two horizons. Prospecting by churn drilling has been suspended, as supplies of equipment cannot be obtained until late in the year. Ore reserves are estimated at: positive ore, 80,000 tons; 22 dwt. per ton; probable ore, 20,000 tons; 15 dwt. per ton. Production figures for the past year are:

| | |
|---|---|
| Ore milled, long tons | 31,003 |
| Head value, dwt. per ton | 14.47 |
| Residue value, dwt. per ton | 1.60 |
| Gold recovered, oz. | 17,461 |
| Recovery, per cent | 88.88 |
| Silver recovered, oz. | 4,956 |

Operating costs for 1945 are shown in comparison with those for 1944, in Fijian currency. Costs for 1945 have been favorably influenced by the operation of the joint mill and also by the mining of about 50 percent of the ore by open cut.

| | Cost per ton | |
|---|---|---|
| | 1944 | 1945 |
| Mining | 27s. 7.9d. | 13s. 2.6d. |
| Milling | 48s. 5.2d. | 27s. 3.1d |
| General expenses | 14s. 2.7d. | 9s. 6.1d. |
| Total | 90s. 3.6d. | 49s. 11.8d. |

# PHILIPPINES

### Chromite shipments resumed from Masinloc mine—Masbate Con. to treat ore for neighboring mines

★Chromite is again coming to the United States from the Masinloc mine, and it is expected that shipments will soon reach 10,000 tons a month. The ore is of refractory, non-metallurgical grade, and is suitable for making chrome firebrick. The orebody is about 50 km. from the coast in Zambales Province, northern Luzon.

★In their three years' occupation of the Philippines, the Japs made no apparent attempt to work the gold mines, but devoted all their efforts to copper properties, even the lowest grade. Most attention was given Lepanto Consolidated, in Mountain Province, and to the Bixbar mine, on Rapu-Rapu Island, off southern Luzon. The installations at the latter mine were destroyed when the Japs left, and the mine has been apparently gutted of readily available high-grade copper ore. The Japs attempted to work the San Remigio copper property in Panay, which had been considered too low grade to touch before the war. They moved the entire Capsay power plant from Masbate to San Remigio for this purpose, but this equipment is reported to be in good condition.

★Although the Japanese wrecked the IXL and the Capsay mills, in Masbate, they left Masbate Consolidated, the major producer, in fair condition. It is reported that this mill, one of the largest in the Philippines, will take custom ore for other Masbate producers whose mills were destroyed.

★Davao is reported to be in far better condition than Manila. Electricity is available in the city, but the water supply has been cut off. Living costs are estimated at 10 pesos daily, exclusive of rent. Reopening of the Davao Gold mine, owned by Elizalde interests, is uncertain.

★Rehabilitation of Philippine mines is progressing slowly due to lack of capital. This is despite the increased activity on the recently reopened Manila stock exchange, where mining stocks are rising in price, in some properties even beyond 1941 levels. Transportation is still a major problem, but interisland shipping facilities are increasing steadily. Air transportation is being developed, and the Philippine Air Lines, managed by TWA, is now offering plane service to the southern islands. An American and British transpacific airline is contemplated, with a stop at Manila.

## C. I. M. M. Convention

(*Continued from Page* 93)

the Sullivan Mine," by C. D. M. Chisholm, assistant mine superintendent, the author described the evolution of a blast-hole diamond drilling method to replace open stoping of the 75-ft. thick main orebody below the 3,900-ft. level, where the hanging wall becomes comparatively weak. Safety and relatively low costs have been achieved with the new method. To the end of 1944, about 456,200 ft. of blast-hole drilling had been done, with the burden per foot of hole averaging 2.9 tons. Explosives consumption is 0.16 lb. per ton in primary blasting and 0.02 lb. per ton in secondary blasting. Tonnage produced from blast-hole mining has increased from 10,127 tons in 1939 to 422,915 tons in 1944.

Secondary blasting at Flin Flon was discussed in a paper by H. A. Kramer and G. M. Proudfoot, of the mine staff. The stoping method, combining sublevel benching and radial drilling, with 85 percent of total production from blast-hole diamond drills, results in a large proportion of heavy blocks. This material is handled in scraping drifts, or "scrams," 9 ft. by 9 ft. in cross-section, driven on a grade of 5 percent in favor of the load. Openings of the draw points, spaced on 25-ft. to 30-ft. centers, permit passage of most of the stope-run muck. Material over the grizzly size, estimated at 15 percent of the total, may be placed in position to be drilled mechanically in the "scrams." About 75 percent of the explosives used for secondary blasting, averaging 0.14 lb. per ton broken, is expended in bringing broken ore through the draw points, and 25 percent in bulldozing in the "scram." An interesting practice which has proved successful in speeding up scraping operations entails tying square knots in broken slusher ropes. Although this materially decreases the life of ropes, discarded hoist rope is used, and the gain in time over splicing compensates. The economical limit of scraping distance in "scrams" is about 125 ft.

### Structures and Ore Deposition

The relationship of structure to ore deposition was the central theme of twelve geological papers presented, in nearly all of which the effect of structure as a controlling factor was clearly brought out.

C. H. Stockwell and J. M. Harrison discussed the relationship of mineralization to both folded and fracture structures in a general paper on "The Pre-Cambrian Shield in Northern Manitoba." Concerning "The Yellowknife Area," Neil Campbell described two mineralization epochs, both connected with and localized by major shearing. Discussing "Falconbridge," Stanley Davidson pointed out that the mineralization definitely represents hydrothermal rather than magmatic segregation and favors permeable zones in the inclosing rocks.

L. A. Trenholme, describing "Belleterre," viewed the gold-bearing quartz veins as filling tension fractures resulting from rotational stresses which were applied to the inclosing, steeply dipping flows; in particular, one large flow acted as a competent unit during deformation and thus localized fracturing. The "Amulet" orebody was described by G. G. Suffel, who showed how ore favored the upper parts of dipping flows, particularly rolls in the flow contacts. The Stadacona Rouyn orebodies were thought by M. E. Wilson and W. R. McQuarry to be localized at the contact of andesite flows with a large diorite sill by reason of the change in competence between the flows and the sills. In describing the Lamaque and Sigma orebodies of the Val d'Or area, G. W. Norman pointed out that the ores occur in granodiorite plugs, but only in a few of many such plugs in a region where the inclosing rocks are intensely deformed.

The ores at "Giant Yellowknife" were portrayed by A. S. Dadson and J. D. Bateman as localized in strong shear zones thought to be purely dynamic, but possibly localized by tuff beds of lower competence. Discussing "Canadian Malartic," D. R. Derry and H. C. Herz showed the ore to be localized in one east-west and one northwest-south-

(*Continued on Page* 138)

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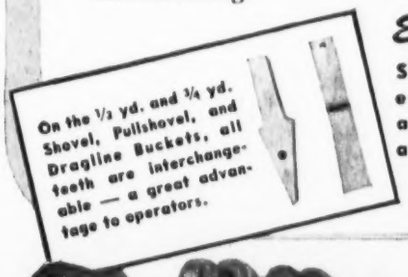

On the ½ yd. and ¾ yd. Shovel, Pullshovel, and Dragline Buckets, all teeth are interchangeable — a great advantage to operators.

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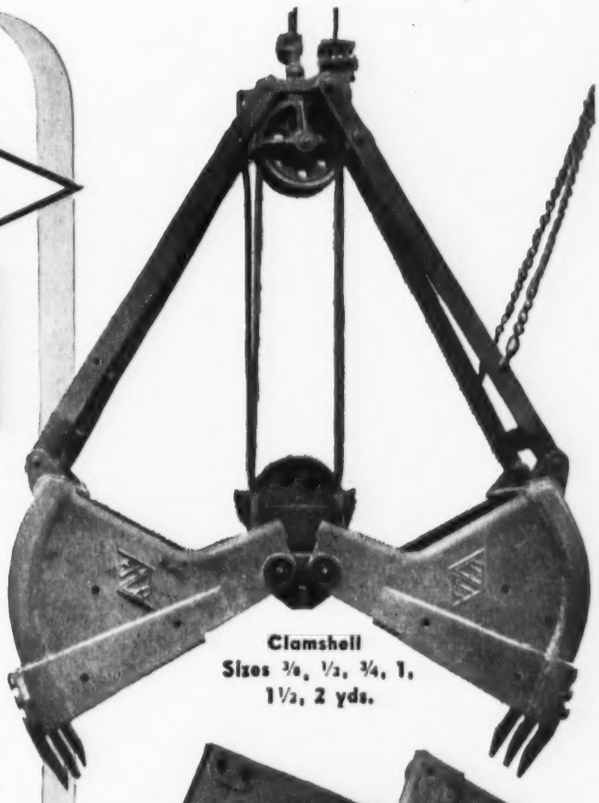
See your shovel man or equipment dealer about PMCO Buckets and Dippers.



Clamshell
Sizes ⅜, ½, ¾, 1, 1½, 2 yds.

Pullshovel
Sizes ⅜, ½ and ¾ yd.

Dragline
Sizes ⅜, ½, ¾, 1, 1½, 2, 2½ yds.

Shovel
Sizes ⅜ to 18 yds.

"Quality Since 1880"

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WE OPERATE THE LARGEST AND MOST COMPLETE MANGANESE STEEL FOUNDRY IN THE UNITED STATES.

Sauerman Scraper Handles a Large Stock Pile

The 1½ cu. yd. Sauerman Drag Scraper in the picture is reclaiming ore tailings from stockpile at Lyon Mountain Mine in the Adirondacks, where several hundred thousand tons are processed each year for sale as highway aggregate and railway ballast. The tailings are screened into various sizes and then are stored in separate piles by Sauerman scrapers, which also take care of the reclaiming and loading into cars or trucks.

FULL SPEED AHEAD!

in any kind of excavating
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Regardless of labor conditions you are well equipped to take care of almost any stripping, open pit, slushing or stockpiling job if you have a Sauerman Power Scraper. One man with controls at his finger tips, easily operates the machine. Anybody can become a trained operator with a little practice.

Sauerman Machines, at their moderate initial cost, soon pay for themselves. These machines are the products of 35 years' specialized experience. Whether you handle a few tons, or many thousand tons a day, there's a Sauerman machine to meet your exact requirements.

Write or wire for advice on equipment to solve your particular problem.

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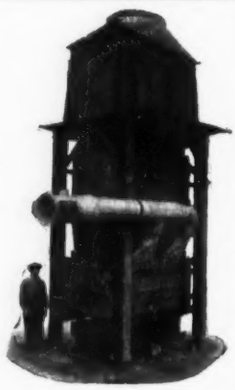
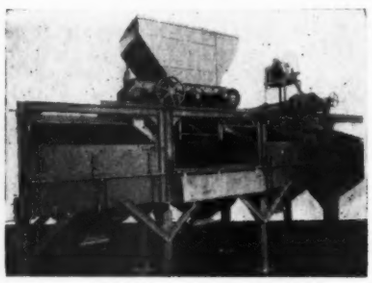
Taking the Smelter to the Ore



eliminates expensive transportation and treatment charges, resulting in savings up to 50%.

Be sure it's a Mace, however. Mace Smelters are made in units to suit individual requirements and enable mine operators to profitably smelt their ores and concentrates.



Mill concentrates are roasted and agglomerated on the Mace Sintering Hearth for reduction in the furnace. The furnace and sinterer together meet all conditions—5 to 250 tons capacity.

Our Denver smelter will make a complete working scale test and report on ton lots or larger.

*Cable or write for literature.*

The Mace Company
FIRE CONCENTRATION METALLURGISTS
2763 Blake St., Denver 5, Colo., U. S. A.


## C.I.M.M. Convention

(*Continued from Page* 136)

east shear zone, particularly along the plunging intersection and where the zones are curved; tension cracks, formed by a reverse movement along the zones, are believed to have influenced deposition.

The description of structural features at "Dome," by T. C. Holmes, presented no clear relationship between a complicated structure and numerous orebodies of various shapes, but the author suggested that the number of rocks closely associated structurally might have localized deformation. H. G. Ames demonstrated that the ore at "Perron" favors east-west shears and northwest-southeast tension cracks in a large embayment of granodiorite surrounded by greenstone, the boundary on one side being formed by a large fault.

### Metallurgical Discussions

Metallurgy occupied the spotlight in three sessions dealing respectively with ore dressing, smelting and refining, and physical metallurgy.

A paper by C. G. McLachlan, H. L. Ames, and R. J. Morton, of the Noranda Mines, Ltd., staff, entitled "Cyaniding at Noranda," described the application of the cyanide process to recover gold from a pyrite concentrate produced by means of differential flotation. "Cyanide and Regeneration Plant and Practice at Flin Flon," presented by the mill staff, outlined practices employed in recovering gold from the tailing product of differential flotation of auriferous chalcopyrite and sphalerite concentrates.

A study of "Copper Losses in Smelter Slags" was presented by A. G. Scobie, of the research laboratory, Deloro Smelting & Refining Co. Losses in slags of similar composition to those of the Flin Flon smelter were investigated with a view to determining the quantitative effect of each slag constituent, observing fluidity, structure, and appearance imparted to the slags by the various constituents, studying the microscopic structure of the slags, and determining relationship of slag composition and matte composition to minimum (equilibrium) copper loss.

### The Eldorado Enterprise

The concluding general session featured the presentation of papers sketching the history and geology of "The Eldorado Enterprise" by the staff of this radium-uranium-silver-cobalt producer at Great Bear Lake.

Discovered in 1930 and successfully brought into production under enormous handicaps of climate and inaccessibility, the property was forced to suspend operation in the early part of the war because of manpower shortages. The reopening in 1942, dictated by experiments in atomic fission already in progress, necessitated extensive unwatering. The subsequent operation contributed substantial quantities of vital

uranium to the Allied development of the atomic bomb, greatly aided by the individual effort of Gilbert LaBine, discoverer of the mine and president of the Eldorado company. Eldorado now ranks as one of the two foremost producers of uranium in the world.

The veins, containing more than 40 different minerals, were described as mesothermal deposits along shear zones in steeply dipping sediments, sills, and flows. Two of these zones show displacements of several miles. The faults strike northeast and dip northwest. Most of the regional mineralization is in the form of quartz-hematite veins representing earlier deposition along faults, some of these veins being very large. The valuable mineralization is of later age. The rich silver ore is confined to the first few hundred feet of depth and may have been concentrated by secondary enrichment. The pitchblende occurs in seams up to a foot wide and several feet long, or in masses several feet in diameter. Oreshoots extend for 200 ft. to 300 ft. in length and up to 600 ft. in height. No diminution of grade has been noted to depth so far penetrated, but the pitchblende tends to lose its reniform structure with increasing depth. The mineralization is associated with a "red" alteration of the wallrock, which is useful in guiding exploration. The alteration is thought to be genetically related to the ore, as the altered rocks are radioactive.

The final paper, presented by H. J. Metz, of the International Nickel Co., concerned "The Frood-Stobie Open Pit." This extensive wartime operation embraced large-scale mining of nickel ore from two pits. The Frood pit, nearly a mile long, 1,200 ft. in maximum width, and workable to a maximum depth of 500 ft., is the larger. The Stobie pit, circular in shape, is approximately 1,000 ft. in diameter and will be mined to a depth of 350 ft. Both pits have 45-deg. slopes and standard bench heights of 45 ft. To obtain maximum tonnage with minimum development work, bench heights were carried to 60 ft. during the war.

During 1945 the monthly tonnage from the two pits averaged half a million tons of ore and an equal quantity of waste rock. The total amount of material moved to date is 58 million tons.

Edgar C. Bain, of Pittsburgh, Pa., vice president of the Carnegie-Illinois Steel Corporation, was the guest speaker at the annual dinner. His address invited greater attention to teamwork in scientific research and attributed the development of the steel industry in the United States since 1900 to the collaborative achievements of research laboratories under the leadership of such men as Edison, Bakeland, and Hull.

The American Institute of Mining and Metallurgical Engineers was officially represented by Louis S. Cates, president of the Institute and of the

(*Continued on Page* 140)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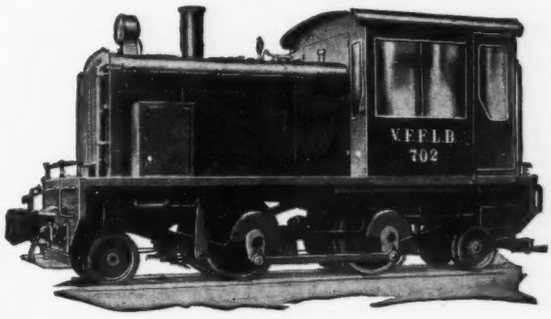

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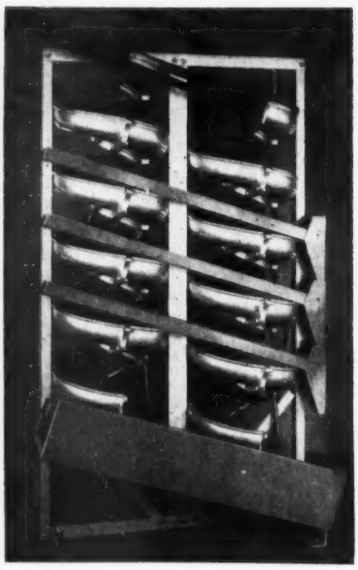
SPIRAL CONCENTRATOR



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NO MOVING PARTS
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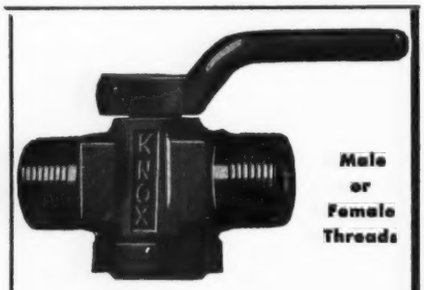
DENVER 2, COLORADO

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Since 1911 Producers of
KNOX
Valves - Couplings - Nipples - Clamps - Menders

## C. I. M. M. Convention

(*Continued from Page* 139)

Phelps Dodge Corporation, who conveyed the greetings of the mining profession in the United States. In addressing the annual dinner, Mr. Cates dwelt on the problem of labor and reconversion currently besetting the mining industry in the United States while expressing the belief that full production would soon be under way.

Outstanding achievements during 1945 were recognized by the award of medals at the annual dinner. The I.N.C.O. medal, presented by the International Nickel Co. of Canada for best service to the mining industry and to Canada, was awarded to T. C. Mackie, of Sydney, N. S., for the Mackie process of treating steel rails. E. C. Roper, of Britannia Beach, B. C., received the Leonard medal for the best paper on the mining industry. The Barlow medal, for the best paper on geology, was presented jointly to V. Dolmage, of Vancouver, B. C., and C. E. G. Brown, of Pioneer, B. C. For the second successive year the Ryan Safety Trophy was won by Mine No. 5 of the Dominion Coal Co., Sydney, N. S. The metal mines safety trophy was awarded to the Garson mine of the International Nickel Co. of Canada.

## Idaho Mining Association Drafts Policies

A declaration of policy on labor relations, subsidies, tariff, stockpiling, public lands, and other subjects of lively significance to the mining industry highlighted the 17th annual meeting of the Idaho Mining Association held on April 5 and 6 at Boise, Idaho.

Averring that the Fair Labor Standards Act, otherwise known as the Wage and Hour Law, is couched in vague and misleading language, the Association recommended amendment of the Act to clarify what constitutes "hours worked" and "wages and regular rates of pay," and to define such terms as "executive, administrative and professional employee." It was further specifically recommended that the Act be amended as follows:

"(a) To prohibit inspectors from acting as collecting attorneys, and from stirring up dissension among employees;

"(b) To prevent the administrator and inspectors from strictly construing coverage and assuming that the employer is always in the wrong;

"(c) To abolish the practice of weighting the regular time of contract employment by including contract earnings in computing overtime earnings;

"(d) To establish a short-time statute of limitations for instituting action;

"(e) To permit employees earning over a certain minimum to refuse to accept awards of back pay;

"(f) To give the courts discretion in imposing penalties;

"(g) To permit the compromise and settlement of claims."

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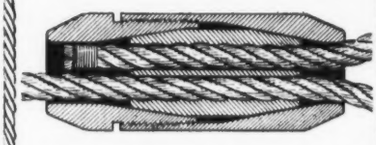
THE NEW WIRE ROPE CLAMP
That Really Holds the Line!



CABL-OX clamps work on a brand new wedging principle. Holding power increases with the load and exceeds tensile strength of rope used. Does not crush and weaken rope like old style U-clips. Assembly is fast, neat . . . saves breakdowns, equipment, injuries and expense. Can be used over and over. Cadmium plated.

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For all wire rope applications.
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The Association declared in favor of a tariff policy adequate to protect the domestic mining industry against unfair competition and the threat of loss of foreign sources of supply in time of emergency. Permanent stockpiling of strategic metals and minerals exclusively for purposes of national defense was indorsed.

Recording its opposition to subsidies, the Association's declaration of policy branded premium prices as a deterrent to free competition and "an indirect method of guaranteeing profits to normally unprofitable undertakings." The raising of domestic ceilings on certain metals to at least the world price, plus duty, was advocated as the first logical step toward the removal of all controls.

## New Phosphate Project for Florida

Plans for immediate construction of a new phosphate mine and plant near Bartow, Fla., have been announced by Louis Ware, president of International Minerals & Chemical Corporation. The plant is expected to have an annual capacity of one million tons and is scheduled to begin operation on July 1, 1947.

The project will contain a number of metallurgical innovations developed by International's research division, providing a higher recovery rate with a higher grade product than has ever been experienced in the industry.

## Publications Received

(*Continued from Page* 100)

**The following Reports of Investigations and Information Circulars have been issued by the U. S. Bureau of Mines, Washington, D. C. No charge is made.**

R.I. 3833. "Chlorination of Magnesia." Pp. 25.

R.I. 3837. "Concentration of Oxide Manganese Ores From Clallan County, Wash." Pp. 13.

R.I. 3841. "Manufacture of Sponge Iron in Periodic Brick Kilns." Pp. 38.

R. I. 3815. Utilization of Three Kids Manganese Ore in Production of Electrolytic Manganese. Pp. 78.

R. I. 3817. Effect of Variable in Chemical Beneficiation of Chromite Ores. Pp. 26.

R.I. 3836, "Metallurgical Treatment of Cobalt Ores from the Goodsprings Mining District, Nevada." Pp. 34.

R.I. 3838. "Rapid Specific-Gravity Method for Estimating the Iron Content of Birmingham, Ala., Red Ores." Pp. 13.

R.I. 3851. "Continuous Hydraulic Classification: Constitution of the Teeter Column Throughout Its Depth." Pp. 9.

R.I. 3852. "Sensitivity of Explosives to Initiation by Electrostatic Discharges." Pp. 8.

R.I. 3834. Beneficiation of Montana Chromite Concentrates by Roasting and Leaching. Pp. 37.

R.I. 3839. Mining and Concentration of Missouri Valley Manganese at Chamberlain, S. D. Pp. 103.

R.I. 3842. Concentration of Manganese Ores from Gila, Greenlee, and Graham Counties, Ariz. Pp. 12.

R.I. 3845. Pilot-Plant Investigations. Preparation of Alumina From Potassium Alum. Pp. 14.

R.I. 3847. Selective Reduction of Iron in Chromite by Methane-Hydrogen and Similar Gas Mixtures. Pp. 14.

R.I. 3844. "Performance of a Hydraulic Classifier Designed to Incorporate Four Hitherto Neglected Principles." Pp. 13.

I. C. 7326. Extractive Metallurgy of Beryllium. Pp. 15.

I. C. 7331. Dust-Counting Cells, Pp. 9.

I.C. 7339. "Mining and Milling Operations of the Southwest Graphite Co., Burnet County, Tex." Pp 9.

I.C. 7341. Survey of Literature on the Metallurgy of Zirconium. Pp. 50.

I.C. 7343. Storage of Explosives in Underground Mines of the Lake Superior District. Pp. 9.

I.C. 7354. Sinking Large-Diameter Drill Holes, Lake Superior District Underground Iron Mines. Pp. 21.

I.C. 7340. "Hazard from Chlorates and Perchlorates in Mixtures With Reducing Materials." Pp 6.


**Backed by 25 Years Experience with Storage Battery Locomotives**

2-motor drive; total 24 h.p.

Series parallel controller.

Extra long journal springs for better trackability.

Oil-tight, leakproof transmission. Use auto oil, renew every 6 months.

Adjustable Timken Roller Bearings throughout.

Strong, simple construction. Low maintenance.

**GREENSBURG "RANGER"**

The Sunshine Mining Company, Kellogg, Idaho has three of our locomotives which have contributed materially toward decreasing their haulage cost. This is a custom-built job.

*All Greensburg Locomotives are* **CUSTOM-BUILT** *to your requirements.*

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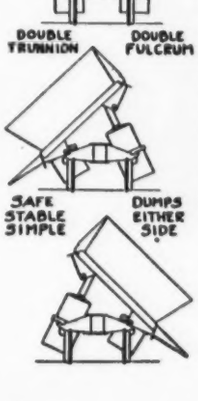


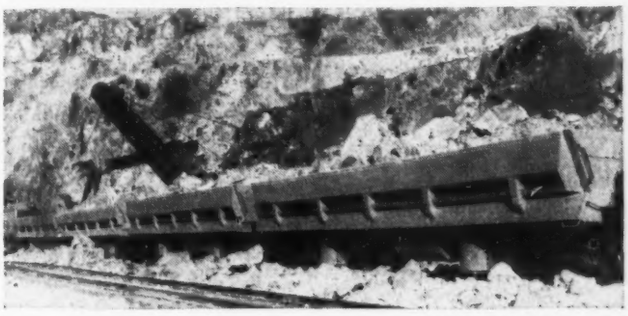

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**DIFFERENTIAL STEEL CAR CO.** . . . . FINDLAY, OHIO

## Industrial Notes

(*Continued from Page* 104)

**Cornell E. Jones** was recently named sales development manager of the company.

**Douglas C. Reybold,** formerly lieutenant in the Corps of Engineers, U. S. Army, has returned to **The Dorr Co.,** with headquarters in New York.

**T. J. Harris** has returned to the **Ohio Brass Co.,** Mansfield, Ohio, after two years' service in the Navy.

**LaPlant-Choate Manufacturing Co.,** Cedar Rapids, Iowa, recently announced plans to establish a new world-wide independent dealer sales and service organization. The company's previous dealer organization is associated with a concern now advertising equipment competitive to that of LaPlant-Choate.

**Robins Conveyors, Inc.,** announces that **R. W. Eichenberger,** vice-president, has moved to the Chicago office to supervise sales in the Western area.

Continued growth of **Denver Equipment Co.,** Denver, Colo., has necessitated addition of a new vice presidency to which **T. S. Bailey, Jr.,** formerly sales manager, has been elected.

**P. A. Alers** has been appointed manager of the El Paso, Tex., office of **Worthington Pump & Machinery Corporation.**

**Harbison-Walker Refractories Co.,** Pittsburgh, Pa., announces that **Frank Weir** has been appointed manager of the St. Louis sales office of the company, and **Karl W. Sieling,** manager of the Houston, Tex., office.

## BULLETINS

**Car Shake-Outs.** Hopper-bottom railroad cars can be rapidly shaken clean by a device described in a recent bulletin, No. 128, issued by Robbins Conveyors, Inc., Passaic, N. J.

**Protective Clothing.** B. F. Goodrich Co., Akron, Ohio, has published a 10-page catalog section on its complete line of industrial protective clothing.

**Filtration.** Importance of the string discharge in continuous filtration with rotary vacuum filters is discussed in a new bulletin of Filtration Engineers, Inc., 858 Summer Ave., Newark 4, N. J.

**Crushing Equipment.** New editions of the comprehensive and well-illustrated catalogs covering the Type H Blake crusher, the Type TY reduction crusher, and the crushing rolls manufactured by Traylor Engineering & Mfg. Co., Allentown, Pa., are now available for distribution.

**Heavy-Media Separation.** Ore Dressing Notes, No. 14, recently published by American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N. Y., contains detailed information on Heavy-Media Separation processes, including notes on several new installations not heretofore discussed.

**Hard-Surfacing.** Use of Hardex welding rods for hard-surfacing equipment such as dipper teeth is discussed in a new bulletin prepared by Metal and Thermite Corporation, 120 Broadway, New York 5, N. Y.

**Clamshell Buckets.** Four-rope clamshell buckets designed for use in handling coal, iron ore, or other free-flowing granular material are described in Catalog 2059 of Blaw-Knox Co., Pittsburgh, Pa.

**Training Supervisors.** Metropolitan Life Insurance Co., Policyholders Service Bureau, 1 Madison Ave., New York 10, N. Y., has available for distribution a limited number of copies of its pamphlet reporting on supervisor training practices of 39 companies.

**Heavy Hauling.** The 15-ton rear-dump Euclid truck and 13-cu.yd. bottom-dump model are described in folders 101 and 201, recently issued by Euclid Road Machinery Co., Cleveland 17, Ohio. Complete specifications and technical information are given.

## Mine Taxation

(*Continued from Page* 66)

public confidence in the fairness of the administration of revenue laws. Taxes should be imposed only by the clear mandate of the law, and doubts should be resolved in favor of the taxpayer.

**Present Federal Tax Laws and Their Administration Fall Far Short of Such Standards.**—We have had emergency legislation in time of depression and emergency legislation in time of war. Our tax laws need revision to bring them into accord with standards such as those here set forth, so that business investment may be attractive and business may be prosperous to furnish the employment and the Government revenues needed over a long period of years. Revisions needed to leave adequate incentive for investment in business enterprise should not be considered as involving a revenue loss to the Government, but rather as being essential to maintaining and creating the incomes from which Government revenues may flow.

## Obituaries (*continued from p.* 107)

was a lieutenant during the first World War, following which he was employed by various mining companies in the Western Hemisphere and abroad. Before joining the National Lead Co., where he made important contributions to the milling of its complex magnetite-ilmenite ores, he was an associate metallurgist with U. S. Bureau of Mines.

**Rudolph Emmel,** secretary and a director of South American Development Co., with which he had been associated for 20 years, and identified with mining interests in Africa as well, died in New York on April 18, aged 54.

**Robert H. Sleeth,** 82, prominent in Mid-Western steel industry, died in Pittsburgh on April 17 as the result of an automobile accident.

**Herbert Charles Ryding,** retired president of the Tennessee Coal, Iron & Railway Co., died on April 12 at Birmingham, Ala. He was 82.

**Walter S. Worden,** Canadian mining executive, died on April 20 at Toronto, at the age of 71.

**Walter Goodwin Swart,** 78, consulting mining engineer, identified with iron mining in Minnesota for many years, and with mining development in the Rocky Mountain states, died at Alameda, Calif., on April 18. He had been associated with the American Zinc, Lead and Smelting Co. in the Tri-State district, with D. C. Jackling in copper development in the Western states, and with Hayden, Stone & Co. in Mesabi Range magnetite research. At the time of his death he was vice president of the Mesabi Iron Co.

**Harry A. Guess,** vice president and director of the American Smelting & Refining Co., and a former consulting engineer of the mining departments of the company, died at Forest Hills, Queens, N. Y., on April 11, at the age of 70. Mr. Guess received his M.E. degree from Queens University, Kingston, Ont., in 1895. He was subsequently engaged in Canadian Mining.

**Stuart Rhett Elliott,** of Ishpeming, Mich., mining engineer, manager of the mining department of Cleveland-Cliffs Iron Co. on his retirement in 1943, died on April 3 at the age of 72. He was a past president of the Lake Superior Mining Institute, a member of the A.I.M.E., and served in France with the 28th Engineers in the first World War, holding at its close, the rank of lieutenant colonel.

**Correction**—An error in transcription caused the publication of an item in the March 1946 issue of *Engineering and Mining Journal* announcing the death of "L. V. McRae." The name should have been given as "L. V. Ray." *E.&M.J.* regrets the occurrence, offers the foregoing explanation in mitigation, and is grateful to the correspondent who provided the opportunity to record this rectification.